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ABSTRACT

A study was conducted to establish the current status of Individualized Instruction (II) in the Navy and other services, identify the factors influencing its effectiveness, identify present or potential problem areas, and recommend strategies/policies to improve II in Navy technical training. Particular attention was given to an assessment of instructor management of II by computer. First, all relevant Navy instructions, directives, and guidance were reviewed and an assessment made of their impact on the implementation and management of II in the Navy. Next, key summary articles dealing with the effectiveness/efficiency of II were reviewed in an attempt to establish a consensus concerning the utility of this instructional strategy. Third, visits were made to key sites in the Navy and other military services where information pursuant to the establishment of a comparative data base on II was obtained. Finally, findings and recommendations were developed on all information obtained. The major conclusion of the study was that the Naval Education and Training Command should continue to use II in Navy technical training. Specific recommendations for the improvement of II were provided in the areas of management information systems, training of instructors and managers, terminology, student-instructor incentives, cost benefit analyses, and further study requirements. (Author/BM)

TAEG Report No. 78

AN ASSESSMENT OF INDIVIDUALIZED INSTRUCTION IN NAVY TECHNICAL TRAINING

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A study was conducted to (1) establish the current status of Individualized Instruction (II) in the Navy and other services, (2) identify the factors influencing its effectiveness, (3) identify present or potential problem areas, and (4) recommend strategies/policies to improve II in Navy technical training. The major conclusion of the study was that the Naval Education and Training Command should continue to use II in Navy technical training. Specific recommendations for the improvement of II are provided in the areas of

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20. management information systems, training of instructors and managers, terminology, student-instructor incentives, cost benefit analyses, and further study requirements.

SUMMARY

Despite the apparent increases in training efficiency associated with individualized instruction (II), there are still legitimate concerns in the Navy with the soundness of the concept in the military context, the manner in which instruction is provided, and the quality of graduates from II programs. To put these concerns into perspective, the Training Analysis and Evaluation Group was tasked to conduct an assessment of II in Navy technical training. The study (1) established the current status of II in the Navy and other services, (2) identified the factors influencing its effectiveness, (3) identified present and potential problem areas, and (4) recommended actions to better articulate to decision makers the rationale of Instructional Systems Development (ISD) as well as to optimize the implementation of II in the Navy. Particular attention was given to an assessment of the management of II by instructors and by computer. Key findings and recommendations from the study are outlined below.

MILITARY APPLICATION OF INDIVIDUALIZED INSTRUCTION

A substantial commitment has been made to the use of II in the military services. An indication of the extent of that commitment is contained in section II of this report. Because of the short time available for this study and the unavailability of certain classes of data, it was not possible to establish the full range of II use by the military services. However, it is clear that the use of II, in particular computer managed instruction (CMI), computer aided instruction (CAI), and programmed instruction (PI), is extensive and is increasing in technical training.

The Navy commitment to II is most visible in CMI. FY 78 data show an approximate student AOB and throughput for CMI courses of 7,000 and 65,000, respectively. There are an additional 3,000 student AOB and 59,000 student throughput for II courses which are not computer managed. CAI usage in technical training indicates 350 to 400 student stations in use or planned. However, an additional difficulty exists in establishing the full extent of CAI in technical training because of the variety of instructional applications of computers designated as CAI. Programmed Instruction is the primary instructional format in all forms of II.

MAJOR INFLUENCES ON THE EFFECTIVENESS OF INDIVIDUALIZED INSTRUCTION

Only a limited amount of evidence is available to describe the existence and operation of factors influencing the effectiveness and efficiency of II. Available data generally indicate that II is as effective as conventional instruction (CI) in terms of end of course achievement scores and that the efficiency of II is superior to that of CI in terms of student time to complete instruction. However, no useful data were found which addressed the relative effectiveness of II for different kinds of training tasks or for varying ability levels of trainees.

A number of factors which exert an influence on the effectiveness/efficiency of II in Navy technical training are identified and discussed in this study. These include:

Organizational Structure. The organizational structure supporting II was identified more frequently than any other factor as having a significant influence on the effectiveness of II. Difficulties associated with this factor include the complexity of the current management structure; problems in integration and coordination of planning, budgeting, and instructional system development processes; and the perceived absence of accountability for specific tasks.

Attitudes. Feelings toward II are mixed. Most students appear to view II either positively or with indifference. Some instructor and user personnel tend to view II as ineffective and/or inefficient; a small coterie is vehemently opposed to II. Most important among the factors contributing to negative attitudes toward II is a dissatisfaction that results from the difference between expected and actual graduate performance. A failure to appreciate the impact of external constraints and changes in course content are major contributors to the development of this dissatisfaction. Additional factors affecting attitudes include confusion in terminology, changing roles of instructors and students, a lack of understanding about instructional strategies, and a perceived lack of management support.

Resources. The primary impact of reduced resources has been on support services at the schoolhouse and there is a widely held perception by lower echelon activities that there is a lack of resource and management support for II programs. Further, there may be a significant waste of resources resulting from a lack of integration between the ISD process and the POM/budget cycles associated with II activities.

Data Bases. A comprehensive assessment of the effectiveness/efficiency of II is not presently possible without the development of appropriate data and record keeping procedures. Some course administration data are available for internal evaluations through NITRAS or the Navy CMI system. Neither of these is sufficient to permit overall analyses of effectiveness. Operational costs for courses and the hardware system supporting CMI are available but course development costs are generally unavailable. The development of a comprehensive/standardized data base for external appraisal is being undertaken by CNET.

Instructor/Manager Training. The instructor's and/or manager's roles in II are still evolving but are clearly different from those in CI. Problems that affect instructor training for II include a lack of resource and management support and the absence of courses based on validated training requirements. In addition, increased stress resulting from longer class and collateral contact hours and changes in the nature of work performed must be addressed.

Administrative Factors. The impact of a number of specific factors regarding course administration, management of students, and management of instructors are identified and discussed in the report. Included in the discussion of course administration are testing policies, predicted completion time, course loading, hardware support, and Management Information System (MIS) requirements. Holding time, remediation, incentives, and housing and messing are included in the discussion of student management. Finally, the discussion of instructor management includes consideration of plowback policies and collateral duties.

CONCLUSIONS AND RECOMMENDATIONS

The evidence presented in this report strongly indicates support for the continued use of II as an instructional strategy in Navy technical training. However, to enhance II effectiveness and efficiency in terms of Navy goals, the following actions are recommended:

. establish a single office/activity with responsibility for the integration and coordination of all aspects of II.

. develop an information package which would communicate the rationale, philosopy, and implementation procedures and policies associated with II and present to all NAVEDTRACOM and major fleet activities.

. initiate and support an effort to determine the relative effectiveness/efficiency of II for different kinds of training tasks and ability levels of trainees.

. develop appropriate data bases and record keeping procedures to:

.. establish the types and extent of II in use throughout the Navy.

.. compare the cost efficiency and training effectiveness of instructional strategies, management systems, and ADP alternatives.

.. facilitate the administration of II in the Navy.

. develop and implement criteria for selecting among alternative instructional strategies, instructional management systems, and/or instructional media.

. ensure the use of standard II terminology throughout the NAVEDTRACOM.

. ensure that the training pipeline for II instructors includes materials appropriate to their role as Learning Center Supervisor/Instructor. Implement this material on an interim basis pending the delivery of instructor training curricula under development.

. develop and implement an II management course for all training administrator and school/course management personnel.

. examine the desirability of providing preparatory materials on the use of computers in instruction for students and/or instructors.

. establish a program to identify incentives and/or procedures which act to improve student and instructor performance in an II environment.

develop and implement a MIS for the management of instructor personnel at individual training locations.

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SECTION I

INTRODUCTION

Over the past quarter century there has been a trend in instructional strategies toward the use of individualized instruction (II). Experience to date has shown that, in general, II is as effective as conventional instruction (CI), its major advantage being that average training time is reduced compared with the various conventional approaches. Although II is frequently identified as a singular concept or approach, often substantial variations in instructional strategy, instructional management, and instructional delivery are subsumed under this general category.

A number of representative summary reports (Orlansky and String, 1979; Northrop Corp., 1971; Lockheed-California Co., 1971; Middleton, Papetti, and Micheli, 1974) have documented the advantages, complexities, and problems of II and have described in detail key issues associated with its implementation. The most prominent of these issues are student achievement, student attrition, training effectiveness, student and instructor attitudes, cost benefits, and instructor functions. Thus, despite the apparent increase in efficiency associated with II, there are still legitimate concerns in the Navy with its implementation and conduct as well as with the quality of graduates from the programs.

The Chief of Naval Education and Training (CNET)[1] tasked the Training Analysis and Evaluation Group (TAEG) to examine II in Navy training and to place the major issues into perspective. The guidance provided called for a quick response effort. In order to meet this requirement, the study was restricted to enlisted technical training and to an identification of broad issues, problems, and analyses. The work was begun in June 1979 and completed in October 1979.

STUDY OBJECTIVES

The objectives of this study were to: (1) determine the current status of II in the Navy and the other military services, (2) identify the factors influencing its effectiveness, (3) identify present or potential problem areas, and (4) recommend strategies/policies to better articulate to decision makers the rationale of Instructional Systems Development (ISD) as well as to optimize the implementation of II in the Navy. Particular attention was given to an assessment of the management of II by instructors and by computer.

BACKGROUND

The history of II in the Navy is inextricably interwoven with the implementation of the systems approach to the design and management of training and with research and development in programmed and computer aided instruction. A brief perspective on these interlocking developments is provided here.

[1] CNET ltr Code N-53 of 22 Aug 1979.

In the late 1960s the systems approach to the design and management of instructional systems was receiving increased attention in the Department of Defense (DOD) and by the Chief of Naval Operations (CNO). This activity served to highlight Navy programs (Rundquist, 1967) which had already begun utilizing the systems approach to instructional program design and which had not only pointed out the need for but already had begun to implement II. Two documents issued during this period (NAVPERS 93510-1 and BUPERSINST 1550.43) addressed the systems approach to training. The first simply noted the trend toward the systems approach, while the second outlined procedures for a systems approach to instructional development and indicated that all BUPERS courses were to be designed in accordance with these procedures.

In 1971, the Assistant Chief for Education and Training (PERS C-229) issued a memorandum to training managers providing guidance and asking for a review of programs and the submission of plans for converting appropriate courses to individual learning systems. In 1973, the Chief of Naval Training (CNT) stated that one of his major objectives was "to restructure all training programs in accordance with the latest and best tenants of instructional technology, placing highest priority on those programs determined to yield maximum benefits in pipeline reduction" (Cagle, 1973). This statement was soon followed by issuance of CNETINST 1550.5, March 1974, which established the CNET policy and doctrine for the centralized control of instructional program development. In September 1974, the CNTT A10 Manual was issued. This manual contained the approved procedure for planning, designing, developing, and managing Navy technical training; i.e., Instructional Systems Development (ISD). Instructional Systems Development has been described as an orderly process for planning and developing instructional programs which insure that personnel are taught the knowledges, skills, and attitudes essential for job performance (Hodak, Middleton, and Rankin, 1979). The CNTT A10 Manual also stated that the preferred instructional strategy for all Navy training courses was II. NAVEDTRA 106A issued in 1975 (phase III, p. 124) reaffirmed that self-pacing (individualization) was the preferred mode of instruction in ISD courses.

In April 1976, CNET announced the decision to establish the Instructional Program Development Centers (IPDC) at San Diego and Great Lakes for centralized instructional program development. In July 1978, CNET issued NAVEDTRA 110, an extension of NAVEDTRA 106A, which prescribed policy, procedures, and guidelines for the analysis, design, and development of all instructional programs within the Naval Education and Training Command (NAVEDTRACOM) except submarine training programs. Thus, the systems approach to instructional development and II became solidly imbedded in Navy training.

Overlapping the evaluation of ISD was the concurrent research, development, and implementation of computer-based training in the Navy. The evaluation of the Navy computer managed instruction (CMI) system is described by Hansen, Ross, Bowman, and Thurmond (1975) and is reviewed briefly here. Its major historical antecedents were the programmed instruction movement of the 1950s and early 1960s and the computer-based instruction work of the 1960s--particularly that sponsored by the Office of Naval Research (ONR). These events together with significant interactions among the ONR, Navy Training Research Laboratory (NTRL), and Chief of Naval Air Technical Training (CNATT) were key to the implementation of Navy CMI. In 1966, the Assistant Secretary of Defense, Manpower and Reserve Affairs (ASD M&RA) allocated funds to initiate the CMI project; the project was begun by CNATT in July 1967. Subsequently, Navy advanced development objectives provided the major funding through direction of Chief of Naval Personnel (CHNAVPERS). The period from 1968 to 1970 was characterized by joint institutional developments involving (1) computer software to support the CMI system, (2) research on media selection and preparation and coding of CMI instructional materials, and (3) feasibility studies of computer aided instruction (CAI) in the CMI system. Approval of the CMI system as an operational element in Navy training was sought in 1970. A cost justification study which supported this request and formulated the basic rationale for the decision to go operational was sponsored by CNET. This was approved by CNO on 5 February 1971, and, after some delays in obtaining resource support, automated data processing (ADP) equipment acquisition was begun. The first course, Aviation Fundamentals, was officially implemented into the system in 1972, and in 1974, CNET and CNTT adopted CMI as a formal component of the Navy training system (CNETINST 5260.1, CNTTINST 5400.7A). In 1975, a contract was let for ADP hardware and services. Finally, CNET Decision Memorandum No. 2 (27 April 1976) integrated CMI with the plans for the redesign of courses by the IPDCs.

The brief historical review contained in the preceding paragraphs outlines the evolution of II in the Navy. It provides a perspective for a more complete understanding of the complex issues associated with II identified in this report.

APPROACH

There were four major components to the approach used in this study. First, all relevant Navy instructions, directives, and guidance were reviewed and an assessment made of their impact on the implementation and management of II in the Navy. Next, key summary articles dealing with the effectiveness/efficiency of II were reviewed in an attempt to establish a consensus concerning the utility of this instructional strategy. Third, visits were made to key sites in the Navy and other military services where information pursuant to the establishment of a comparative data base on II was obtained. Finally, findings and recommendations were developed on all information obtained. This latter information was obtained primarily in interviews conducted on site. A list of commands and activities contacted is provided in appendix A.

DEFINITIONS

Because accomplishment of study objectives required precise terminology, the following definitions were established and are used throughout the report. They are based on and are consistent with current CNET (CNETINST 1500.12) definitions and reflect the distinctions between instructional strategies, instructional management systems, and instructional delivery systems (media).

<u>Individualized Instruction (II)</u>. An instructional strategy in which all learning activities are designed to accommodate individual differences in background, skill level, aptitudes, and cognitive styles. Individualized Instruction is characterized by the following attributes:

- releasing of time constraints.
- choice of instructional media

instruction adjusted to skill levels and learner characteristics. It often employs programmed instruction.

Conventional Instruction (CI). An instructional strategy in which learning activities are directed toward a normative model of the target population characteristics and usually delivered in a group environment. It is characterized by:

- predetermined group pacing
- preselected nonvariant media
- predetermined nonvariant instruction.

These characteristics, once established, are employed with all members of the group.

Programmed Instruction (PI). An instructional format which presents individualized materials in a sequence of small units each of which requires an immediate response from the trainee and which also provides the trainee with immediate knowledge of results.

Programmed Instruction Text. An instructional delivery system which employs programmed instruction.

Computer Aided Instruction (CAI). An instructional delivery system in which a computer system is used to provide instruction and where there is an ongoing interchange of stimulus and reaction between the computer and trainee. When a CMI capability coexists within the host computer system, the computer system serves both a media and management function.

Computer Managed Instruction (CMI). An instructional management system in which a computer is employed to prescribe a series of instructional materials for individual trainees. Usually associated with II, it may include the capability for record keeping, testing, counseling, and the selection of various media for the delivery of instruction.

Instructor Managed Instruction (IMI). An instructional management system in which the instructor prescribes a series of instructional materials for individual trainees. It is usually associated with the delivery of II and may include the capability for record keeping, testing, counseling, and the selection of various media for the delivery of instruction.

Instructional Systems Development (ISD). A systematic process (framework) for applying approved procedures and techniques in the development and conduct of training. This process usually includes five phases: analyze, design, develop, implement, and control.

ORGANIZATION OF THE REPORT

In addition to this introductory section, the report contains three other sections. Section II summarizes the status of II in the military services, provides a brief overview of research bearing on II, and presents a review of economic analyses of II in the Navy. Section III contains the findings of the study regarding those factors influencing the effectiveness/efficiency of II in the Navy. Section IV contains conclusions concerning trends in training, technology, and manpower which may influence Navy training. The section also contains recommendations for the improvement of II in the Navy.

Several appendices are included in this report. Appendix A lists the commands and activities visited; appendix B contains a model and an algorithm for the economic analysis of II in the Navy; appendix C contains a listing of Navy technical training courses which employ II.

SECTION II

THE CURRENT STATUS OF INDIVIDUALIZED INSTRUCTION IN THE MILITARY SERVICES

This section contains an overview of the current status of II in the military services and summarizes relevant literature regarding its effectiveness and/or efficiency. No attempt is made to trace the developmental history and implementation of II in environments other than the military. The reader interested in the broader issues and applications of II is referred, for example, to Skinner (1968), Blaisdell (1973), O'Neal (1970), Robinson and Lautenschlager (1971), Abramson (1970), and Mitzel (1971).

THE EFFECTIVENESS OF INDIVIDUALIZED INSTRUCTION

A significant portion of military training resources has been devoted to II. Initially, this commitment was in the form of programmed texts. Gradually, however, more and more aspects of instructional delivery have been automated. At the present time, II seems to be primarily identified with computer managed and/or computer aided instruction. This is unfortunate since this focus on the automated aspects of II has affected the ability to identify and track other forms of II. In their comprehensive review of computer based instruction in military training, Orlansky and String (1979) identified four major categories of data reflecting either training efficiency or effectiveness of computer based instruction. These included achievement, time savings, attrition, and attitudes of students and instructors.

In terms of course achievement, CAI was found to be superior to conventional instruction in 15 studies, inferior in one study, and 24 studies showed no difference. When compared with PI, CAI was found to be superior in one study out of five; there was no difference in four studies. However, course achievement as a measure of the relative effectiveness of alternative instructional strategies should be used with caution. It is inevitable that few differences in achievement have been found since students remain under instruction in CAI and CMI until they achieve standards equivalent to those set for CI.

Time savings associated with CAI and CMI are dramatic when compared to CI. It was reported that CAI saves approximately 29 percent (median) with a range reported of 10 to 89 percent. Thirty-six of 40 cases reported a time savings, three reported increases in course completion time and one reported no difference. Computer managed instruction (seven cases) is reported to save approximately 44 percent (median) in course time with a range of 31 to 89 percent. When CAI and CMI were combined in a single program, savings of 32 percent (median) in course time were obtained.

The significance of time savings, however, must be interpreted cautiously since often these savings are not only associated with the introduction of CAI or CMI but also with simultaneous revisions in course content. The primary savings in time seems to be associated with conversion of the course from a CI format to an II format; the addition of computer support (either CAI or CMI) to II does not seem to increase the time savings significantly (5 percent for CAI in five courses; 0 percent for CMI over seven courses). No studies were found which compared CAI and CMI course completion times. The data with regard to the relationship between academic attrition and computer-based instruction are equivocal. The Air Force reported an increase in attrition for four courses on the Automated Instructional System (AIS); however, attrition in all courses at Lowry Air Force Base increased during the same time period and the reasons for the increase were uncertain. The Navy reported an increase in attrition for six CMI courses over a 15-month period and a decrease in attrition for one course. The Army reported that academic attrition was about the same for two courses in basic electronics whether taught by CAI or CI. Another Army study reported 22 percent lower attrition for a CAI course (Orlansky and String, 1979).

Studies of attitudes showed that students usually were favorable toward CAI or CMI relative to CI. On the other hand, instructors were more favorable toward CI than toward CAI or CMI.

In summary, CAI and CMI are reported to be as effective as CI in military training when measured in terms of achievement (Orlansky and String, 1979). A more appropriate measure of effectiveness is the relationship of training to job performance in operational units. While the correlation is thought to be high, this has not been demonstrated either for CI or computer based instruction. A summary of findings on CAI and CMI when compared to CI is presented in table 1.

It is believed that transforming a course from CI to II saves student time in three ways. First, higher aptitude students are permitted to progress at rates consistent with their skill. Second, when courses are modified, irrelevant materials tend to be eliminated. Third, special remedial materials can be provided to students on the basis of information gained through frequent diagnostic testing.

The addition of computer support to II does not appreciably increase the amount of student time saved but may bring certain benefits such as reducing costs for maintaining records and producing management reports. Computer managed instruction has no direct educational effect on the student; the benefits are in the area of course management. There is insufficient evidence at this time to determine the exact nature and extent of the savings due to the use of CMI. Individuals contacted during the study believed that the speed with which performance feedback is given and the availability of increased management information makes CMI worthwhile.

Unfortunately, little has been done to compare the cost effectiveness of various alternative instructional systems within DOD. For example, after an exhaustive search for analyses dealing with CMI and CAI systems, Orlansky and String (1979) concluded that no data are available that permit comparisons between the costs of computer-based and conventional instruction. This finding is supported by data reported in subcommittee hearings in the U.S. House of Representatives (Computers and the Learning Society, October 1977). Efforts during the TAEG study to find past cost comparisons of

TABLE 1. SUMMARY OF FINDINGS ON CAI AND CMI, COMPARED TO CONVENTIONAL INSTRUCTION

Measure	Finding (Compared to Conventional Instruction) CAI		CMI	Comments
Student Achievement	Same or more		Same	Performance measured only at school. Relation between performance at school and on the job not demonstrated. Observed differences not of practical importance.
Course Completion Time	No. of Comparisons	40	8	CMI: Most time savings maintained or increased with extended use.
	Time saved (Median)	29%	44%	
	Range	-31 to 89%	12 to 69%	
	No. of Comparisons	5	7	Computer-support saves little time beyond that of individualized instruction.
	Time saved Individualized Instruction,	64%	51%	
	CAI	69%	CMI 51%	
Student Attrition	About the same		Slight increase may occur	CAI: very limited data CMI: possible decline in student quality
Student Attitudes	Favorable		Favorable	
Instructor Attitudes	Unfavorable		Unfavorable	Very limited data. Little attention given to instructors.
Cost	Less, due to student time savings		Less, due to student time savings	Data limited and incomplete.
Cost-effectiveness				Not known because cost data are limited and incomplete.

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SOURCE: Orlansky and String (1979)

computer based and conventional instruction were equally disappointing.

Studies have been performed which claim that one system is more efficient than another. However, these fail to provide conclusive proof because they (1) do not count the complete costs of the system and (2) fail to show the costs of alternative systems. For example, studies of the Navy CMI system (Carson, Graham, Harding, Johnson, Mayo, and Salop, 1975; and Hanson, Ross, Bowman, and Thurmond, 1975) failed to include a comparison of CMI costs with the costs of alternative instruction systems, computer hardware costs, or both. In addition, estimates of course development costs in one of these studies were so low as to be considered immediately suspect. Representative data are summarized in table 2.

The following paragraphs summarize the status of II in the Army, Air Force, and Navy. The comprehensiveness of these status reports was limited by the brief time available for the study.

U.S. ARMY

The Army Training and Doctrine Command (TRADOC) is the single agency responsible for all training and performance testing. The Army's training objectives have been described by Brown, Brandin, Cole, Marshall, Rubin & Waksman (1973) as follows:

- Training will be based on performance of students ("hands-on") as opposed to an instructor demonstration course.
- Emphasis of training will be more on functional context rather than subject matter.
- Absolute criteria rather than normative criteria will be used.
- Testing will be performance oriented and measurement will be on a go/no-go basis.
- Individualized instruction will be used to the greatest extent possible.
- Feedback will be provided at the training site and to training management.
- A quality control system will be used.

An aspect of training emphasized by TRADOC is the use of Skill Qualification Tests (SQT) for advancement by proficiency as well as providing feedback to schools on field performance of personnel. TRADOC began placing a heavier emphasis on II in the mid-1970s. The Army Training Development Institute (TDI), a TRADOC activity, maintains the position that II (based on Systems Developed Instruction) incorporates the following factors:

TABLE 2. SUMMARY OF STUDIES REPORTING COST SAVINGS ASSOCIATED WITH VARIOUS METHODS OF INSTRUCTION

Method of Instruction	System	Service	Location	Time Savings (%)	Number of Courses	Number of Students in Experiments	Number of Students Assumed for Estimate	Estimated Savings Per Year	Reference
CAI	PLATO IV	A	Aberdeen	05 80	3	535	–	PLATO IV not cost-effective[1]	U.S. Army Ordnance Ctr. and School (1976)
	PLATO IV	N	No. Island	67	1	22	200 pilots per year	$0.57M[2]	Crawford, Hurlock, Padilla and Sassano (1976)
	PLATO IV	AF	Chanute	19 27	4	1281	375 per week	PLATO IV not as cost-effective as programmed instruction[3]	Dallman, DeLeo, Main and Gillman (1977)
Conventional (revised course)		N	Memphis	50	4	400	300 per class per week	$ 6M[4]	Carson, Graham, Harding, et al. (1976)
CMI	Navy CMI	N	Memphis	41 70	4	400	300 per class per week	$ 3M[5]	Carson, Graham, Harding, et al. (1976)
	Navy CMI	N	Memphis	–	–	–	–	$ 8,000 FY 75[7]	Briefing material (1978)
							–	$ 9,000 FY 76[7]	Briefing material (1978)
							52,672 graduates[8] (actual)	$10,000 FY 77[7]	Briefing material (1978)
	AIS	AF	Lowry	24 35	4	–	21,128 (actual)	1417 m/yrs $ 600 (4 yrs)	Jul.1, 1974-Sept.31, 1978 Briefing material (1978)
	AIS	AF	Lowry	10 52	4	–	5661 (actual)	710 m/yrs $ 300[10]	Oct.1, 1977-Sept.31, 1978 Briefing material (1978)
	AIS	AF	Lowry	3.6 12.5[9]	4	–	–	AIS cost-effective compared to instructor supported self pacing on one course, not in others; computer costs small in comparison to other school costs	Feb. 1978-July 1978 AIS Service Test Briefing material (1978)

[1] Due to high communication and maintenance costs; PLATO IV cost effective on basis of costs of developing and revising course materials; all comparisons with regard to self paced instruction by sound-on slide or television cassette.

[2] Pro rated from cost avoidance of $5.7M over 10 years *provided* other training applications found to provide full time utilization of PLATO IV terminals; the S 3A co pilot training required only 8 percent of this capacity. Baseline was workbook and use of high fidelity simulator of the Integrated Control System panel.

[3] Because of greater developmental and operating costs for PLATO IV.

[4] Compared to conventional instruction before revision.

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[5] Savings due solely to course revision.

[6] Incremental to $6M above.

[7] Cost avoidance savings.

[8] Average on board, 8863

[9] Comparison of manually self paced instruction vs. CMI in special test.

[10] Derived by pro-rating estimate shown above.

4 17 79

SOURCE: Orlansky and String (1979)

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- critical job tasks
- performance based instruction
- performance based criterion testing
- delivery system
- individual paced
- reinforcement/performance warranty.

An accurate count of Army courses that are individualized is unavailable. Only a few of the Army's self-paced courses are open-entry and only about 50 to 75 are open-exit courses. TDI is currently assessing the extent of II in the Army (including how many courses are self-paced and how many are contractor developed or in-house developed) and determining problems and effectiveness of its use in the school. However, it appears that there is a trend to return to GI because of changes in managers.

At present, the major operational CAI system in the Army is the Computerized Training System (CTS) formerly located at Ft. Monroe. This is the original Army CAI system. The CTS is now located at the Signal School, Ft. Gordon, Georgia. It teaches only 10 percent of three courses (radio, teletype, and avionics equipment repair) due to the hands-on nature of the courses. The CTS has 96 terminals and the combined load is 500 trainees.

The Signal School is in the process of reconfiguring the CTS to an Automated Training Management System (ATRMS). Four hundred twenty-five trainees currently receive training on the system. The reconfiguration is being implemented from the beginning of the course; 800 trainees in the basic radio-telegraph and teletypewriter operator courses who are in the last weeks of training are still in lockstep mode. Full operation is expected within 2 months. At that time, there will be approximately 1,500 trainees average on board (AOB) in training. Plans are also being developed to put the faculty development courses on ATRMS. This will give them a permanent record of all faculty improvement efforts. Six minicomputers are used to service 32 terminals for three basic courses. ATRMS has the capability of managing any trainee in more than one course at a time. Trainees can take the operator courses and at the same time take a course in International Morse Code.

The Signal School staff has encountered some difficulties in implementation. Control of students has been a problem because of very large throughput courses. Further, courses depend heavily upon the written word as a result of direction to make training packages "exportable." The trend within TRADOC presently is to export as much training into the field as possible and since CAI is not practical for such use, reliance has been placed on written materials.

In addition to ATRMS there are a number of new CAI systems being implemented in the Army. Ft. Gordon will be the testbed for Adaptive Computer Training System (ACTS) and Reactive Electronic Simulator (REESE). The Army also plans to use the Educational Computer Corporation's EC-2/3 systems for the following applications:

- Cobra Helicopter training: 72 student stations for seven systems at Ft. Eustis

- Black Hawk Helicopter training: 22 student stations at Ft. Gordon, plus one station for the composite system at Ft. Rucker

- M60 Tank: 25 student stations at Ft. Knox and Aberdeen Proving Ground,

- M109/M110 Howitzer: four student stations at Ft. Sill.

Finally, Plato is being used by the Army in the following training:

- Ft. Shafter: three terminals to deliver general education to military personnel

- Schofield Barracks: five terminals for wheeled vehicle maintenance and to deliver general education to military personnel

- Tobyhanna Army Depot and Letterkenney Army Depot: terminals to deliver general education to civilians.

The major prototype of the Army CMI system, the Advanced Instructional Management System (AIMS), is located at Ft. Sill. This system was adapted from the Navy's Versatile Training System (VTS) and is used as a personnel tracking system as well as a training management system. It is anticipated that AIMS will be on line in 1981 and will expand to include a number of TRADOC activities. It is also anticipated that the Signal School's ATRMS will be subsumed under AIMS as they will be providing similar services.

The TDI has been heavily involved in contracting related to II programs. TDI also has a 3-year program to investigate specific applications of CAI to Advanced Individual Training (AIT) for Military Occupational Specialities (MOS). They will select MOS courses having unique training problems in which CAI can be utilized as a solution and are to make extensive use of the latest microprocessor technology and develop unique low cost, cost-effective delivery systems. Twelve courses have been completed under contract ($1,434,400) and nine courses are being developed ($1,581,300). Further, a "modest" program costing $1,810,000 was initiated in 1976 to assist schools in systems development of instruction by providing contract resources.

Finally, TDI has a contract with Appli-Mation, Inc., Orlando, on Computer Assisted Instruction Training Delivery System (CAITDS) to investigate the use of tactical computers to deliver training. It has four tasks: (1) identify training applications for the Tactical Computer Terminal (TCT), (2) provide cost analysis and operational computer conditions and deployment of the TCT, (3) identify training applications for the field (processor controlled system), and (4) provide cost analysis and operational conditions and deployment of other tactical processors.

U.S. AIR FORCE

There is no official Air Force policy on II (Goldman, 1979). However, according to Brown, et al. (1973), the Air Force has the following goals and training objectives:

- increase job-relevancy of training
- reduce training time
- use audiovisual devices creatively
- make instructors problem solving managers of instruction
- make training responsive to rapid changes in manpower requirements
- tailor courses to job performance objectives
- use criterion-based tests.

Despite the lack of official Air Force policy on II, there are pressures for self-pacing in advanced courses (the 7-skill level of the AF 3, 5, and 7-skill level system). It is believed that II is of most value at this level of training because of heterogeneity of students in the courses.

The Air Force has 110 self-paced courses, which according to Goldman (1979) are about 10 percent of Type II and III courses. The various types of Air Force courses are identified as:

Type I:	Factory (contractor taught)
Type II:	Special, modular, short course, specific equipment or new procedures
Type III:	5 and 7 level, Basic and Advanced courses
Type IV:	Field training detachments.

It is important to note that in spite of the fact that only 10 percent of Type II and III courses are self-paced, 22 to 25 percent of the student load is in self-paced courses.

The major Air Force CAI system is the Advanced Instruction System (AIS). It was designed to teach four courses and is currently used to teach one. Originally intended as an operational device it presently is being used by the research and development community. Currently, AIS is primarily used in a CMI mode (90 percent) for the one course resident in the system. The fact that this system failed to meet its original objective has been attributed to a lack of an effective program for institutionalizing the instructional innovation. In some cases, deliberate attempts to subvert the system were reported. Other CAI installations in the Air Force include:

- thirty Plato terminals at Sheppard Air Force Base for training physician's assistants

- twenty Plato terminals at Chanute AFB for special vehicle maintenance
- Worldwide Military Command and Control System (WWMCCS) at Keesler AFB with 16 remote sites around the world
- several hundred 5-6 week courses using local computers administered by the Air Training Command (ATC)
- command-unique CAI/CMI; e.g., at Air University, Scott AFB, McDill AFB
- base level computers for on-the-job training in Civil Engineering, personnel, and accounting/finance
- personnel/administrative specialists are being trained in a basic 3-level course using a remote processor with training tapes sent to local sites.

There appears to be an interest within the ATC in establishing "lessons learned" in II, CAI, and CMI.

U.S. NAVY

Historical aspects of the Navy's concern with II was provided in section I. The Navy clearly is in the forefront of the attempt to increase the efficiency of technical training through the use of II. For example, table 3 shows the projections for currently planned CMI installations (Van Matre, 1979). However, this increased emphasis on II is only partially attributable to technological innovation and foresightedness. Table 4 contains information compiled by the Master Chief Petty Officer of the Force (MCPOF) of the CNET. The table shows representative increases in technical time-to-train requirements for similar weapons platforms as a function of time. When compared with projected training resource requirements (figure 1) using current methods of training, it becomes obvious that either additional resources will have to be obtained or training efficiencies will have to be effected if the Navy is to maintain the desired levels of readiness. In the present climate of austerity, it is unlikely that resources in the amounts required will be available. Thus, it seems likely that the use of II as one means of increasing instructional efficiencies will continue to grow. A 1976 report on the individual learning system at the Naval School of Photography (NTTC ltr Code 01 of 15 October 1976) provides an example of the cost efficiencies possible. In a 4-year study, documented savings on course length reductions were 326K, 208K, and 255K for FY 74, 75, 76 respectively. In the same period, 737K in cost savings were realized from staff reductions. This efficiency was not obtained at the expense of quality. Graduates of this program averaged 5 to 7 percent higher on the comprehensive course exam than under lockstep training and there was no apparent decline in quality of graduates as perceived by fleet personnel.

The current use of II in Navy training is known to be widespread. The following paragraphs describe the extent of the major components in the Navy including CMI, IMI, PI, and CAI. The comprehensiveness of these descriptions was limited by the time available for the study and the availability of necessary data. The data in table 5 provide a perspective

TABLE 3. PLANNED MILITARY CMI SYSTEMS

	NAVY CMI	AIR FORCE AIS	ARMY CTS	ARMY AIMS	MARINE CORPS CBE
Students Daily	16,000	2,400	365	1,600	2,000
Courses/Schools	25	4	4	2	4-8 CAI 40 + CMI
Locations	6	1	1	1/22	1

Source: Van Matre (1979)

TABLE 4. REPRESENTATIVE INCREASES IN TECHNICAL TRAINING TIME-TO-TRAIN REQUIREMENTS

SURFACE	DD-962 Class (1960)	DLG-26 Class (1973)	DD-963 Class (1973)
Sonar Technicians (Man-weeks)	63	504	718
Data System Technicians (Man-weeks)	0	0	500
Machinery/Electronics/Weapons Technicians (Man-weeks)	810	3367	4671
AIR	**F-8 Crusader (1955)**	**F-4J Phantom (1966)**	**F-14 Tomcat (1973)**
Total Maintenance Personnel (Man-weeks)	573	785	1050
SUBSURFACE	**SS-563 Class (1951) Diesel**	**SSN-585 Class (1959) Nuclear Attack**	**SSBN-616 Class (1963) Nuclear Ballistic**
Total Technical Personnel (Man-weeks)	1675	4300	6400

Source: Master Chief Petty Officer of the Force (MCPOF), CNET

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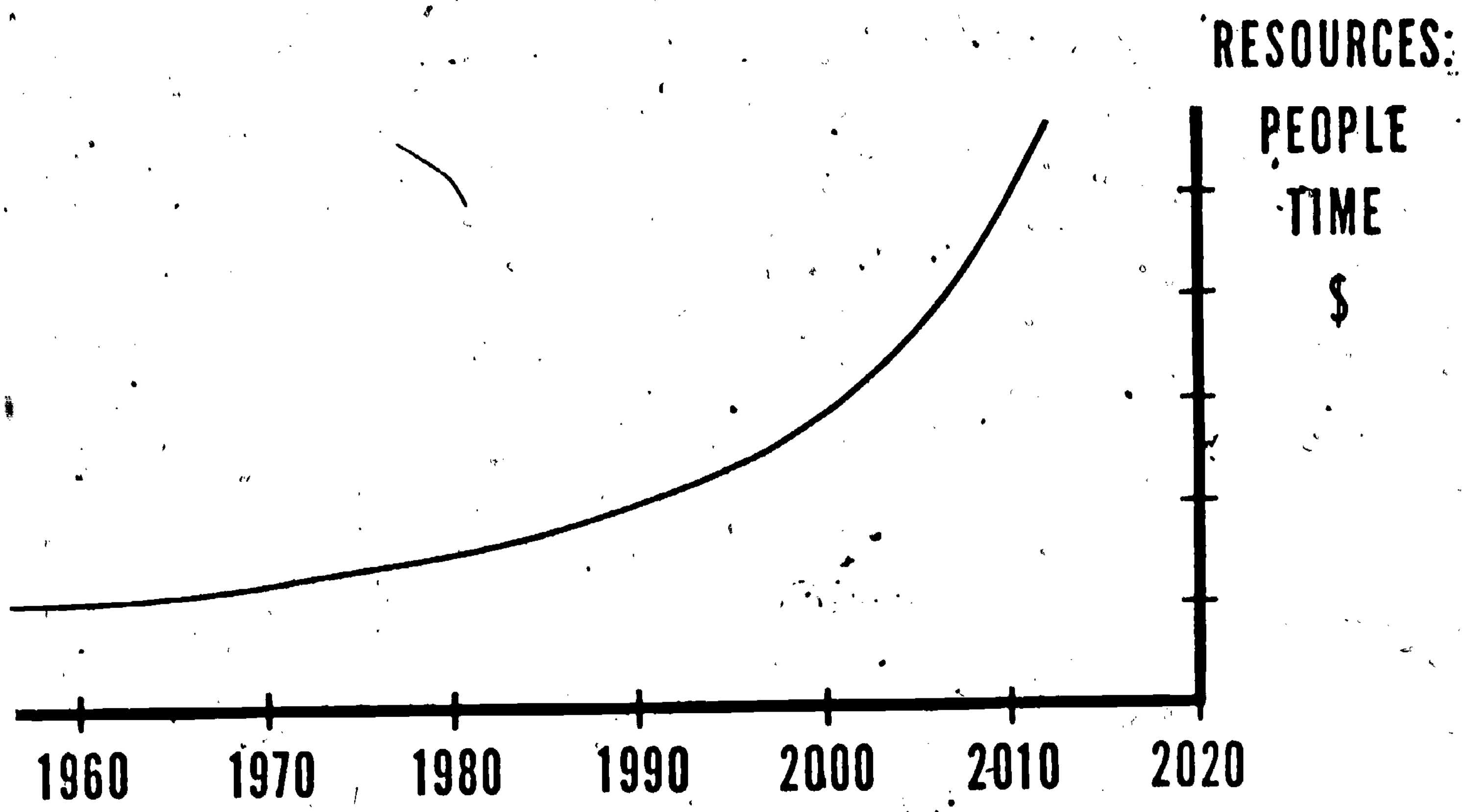


Figure 1. Future Training Resource Requirements Using Current Methods

Source: MCPOF, CNET

TABLE 5. ENROLLS AND AOB DATA BY METHOD OF INSTRUCTION FOR FY 78*

Method of Instruction	FY 78 Enrolls	AOB Under Instruction	AOB Awaiting Instruction	AOB Awaiting Transfer	Number of CDPs
Combination of Methods of Individualized Instruction	43,705	5,116	792	206	116
Computer Managed Instruction	22,867	1,679	419	26	32
Group-Paced or Lock-Step Instruction	615,751	42,970	3,407	1,838	5,156
Self-Paced Instructor	58,704	2,990	300	296	214
TOTALS	741,027	52,755	4,918	2,366	5,518

*Specialized Training only (i.e., A,C, and F type courses)
Source: CNET, Code N-302

by which to evaluate the information in subsequent paragraphs of this section. The table summarizes enrollments and AOB as a function of type of instruction.

COMPUTER MANAGED INSTRUCTION. CMI is the largest component of what is generically referred to as II in the NAVEDTRACOM. With some activities of the NAVEDTRACOM, and certainly among user activities, CMI has come to be synonomous with II, self-paced instruction, and, occasionally, ISD. Unfortunately, this confusion has often resulted in inappropriate criticism of CMI. However, because of its inherent record keeping capability it is possible to provide some relatively detailed information on the status of this system.

The following data provides a thumbnail sketch of CMI system operation.

- Daily average student load (AOB): 6,795 (FY 78)
- No. locations using CMI: 5
- No. schools currently using CMI: 14
- Annual throughput of courses on CMI: 66,572 (FY 78)
- No. daily transactions on the computer: 26,508 (20 Aug 1979)
- Annual budget for computer operations: $3,350,000 (FY 78)

Table 6 identifies the major technical training courses currently on the CMI system and provides their AOB and annual throughput. AOB and annual throughput for individual course data processing (CDP) numbers of all CMI courses are included in appendix C.

TABLE 6. LISTING OF II COURSES CURRENTLY MANAGED BY COMPUTER - FY 79

Course Name	Type of Course	AOB	Annual Throughput
Basic Electricity and Electronics	AP	4,506	19,788
Propulsion Engineering	AP	1,177	9,059
Radioman	A1	842	5,223
Aviation Mechanic	A1	386	2,908
Aviation Fundamentals	AP	1,099	17,632
Avionics Technician	A1	1,247	2,968

Table 7 presents the interim FY 79 CMI Implementation Plan as promulgated by the CNET. This guidance may be superseded as NAVEDTRACOM realignment/reorganization plans become effective. Nevertheless, the expansion of the CMI system is expected to reach a capacity of about 16,000 students at 25 schools in six locations by the mid-1980s.

TABLE 7. FY 79 CMI IMPLEMENTATION PLAN

Course	Location	Operational Planning Date*
IC	San Diego, CA	79/2
PE EXP (BT)	Great Lakes, IL	79/2
PE EXP (MM)	Great Lakes, IL	79/3
SK	Meridian, MI	**
AK	Meridian, MI	**
EM	Great Lakes, IL	79/4
DP	San Diego, CA	80/1
IT	San Diego, CA	80/3
IT	Great Lakes, IL	80/3
IT	Memphis, TN	80/3

*Expressed by FY/quarter; date at which validation revision of course development has been completed.
**The advisability of implementing SK/AK courses is being reviewed because of staffing cuts.

Source: CNET ltr Code 526, 18 Jan 1979

INSTRUCTOR MANAGED INSTRUCTION (IMI). The implementation of II as an instructional strategy has not been limited to courses managed by computer. A number of courses, or segments of courses, employ an instructor-managed "self-paced" delivery mode to transmit instruction. Because of low throughputs, or other considerations, it was determined that it was not feasible and/or economic to manage these courses by computer. In IMI, instructors prescribe instructional sequences, give and score examinations, maintain records, and provide counseling and guidance. Actual instruction, however, remains the responsibility of the student working with some form of II.

The current reporting system makes it difficult to identify all courses in the NAVEDTRACOM that can be classified as IMI courses. However, based on information available from the Navy Integrated Training Resources and Administrative System (NITRAS), it is possible to identify a number of specific courses that fall into this category. Appendix C lists the FY79 enrollment, number of graduates, and AOB for all technical training courses identified as containing some degree of II including those managed via IMI. Major individualized courses which employ IMI, their AOB and throughput are listed in table 8.

TABLE 8. LISTING OF MAJOR INDIVIDUALIZED COURSES MANAGED BY INSTRUCTORS - FY 79

Course Name	Type of Course	AOB	Annual Throughput
Yeoman "A" Course	A1	212	1,146
Personnelman "A" Course	A1	129	893
Supply Technician "A" Course	A1	120	823
Engineman "A"	A1	124	1,611
Machinist Mate "A"	(600 and 1200 PSI)	638	4,808
Aviation Boatswain Mate, Fundamentals	AP	45	1,028

It is not possible to predict the future mix of courses with regard to instruction type with any degree of certainty. However, with a policy that maintains a preference for II (NAVEDTRA 106A, phase III, p. 124) and increased emphasis on efficiency in training, it is likely that II will become even more imbedded in the NAVEDTRACOM. However, it will be necessary to develop an algorithm for assignment of courses to IMI or CMI if full advantage is to be made of these management strategies.

PROGRAMMED INSTRUCTION. Programmed instruction is normally delivered via texts containing summary information, a narrative, or a sequenced learning program. It can; however, be delivered through a variety of media or combined with various management strategies; i.e., CAI, CMI.

Currently, programmed instruction is a key component in II. It is also the most difficult component to document in terms of degree of use in NAVEDTRACOM courses. Programmed instruction is found in almost all course types, including CI where it might be used for remediation, the transmission of noncourse information, or augmenting of instruction; e.g., after hours study.

The Chief of Naval Technical Training (CNTECHTRA) has produced a Catalogue of Naval Technical Training Publications (CNTT-A-68) which lists some 800 titles described in the catalogue as being PI texts or part of a PI instructional package. These titles address subjects in a large variety of technical training topics used in many different courses. It is assumed that in the time since this catalogue was published, other course materials have been developed using PI. It should be noted that other types of training; e.g., Officer, General Military Training (GMT), probably employ PI but a survey of these areas was beyond the scope of the present study.

It is anticipated that PI texts will continue to be a primary delivery medium. The cost of audiovisual materials and the additional time that is required to develop and test other forms of instructional delivery/management associated with II will limit their use in a time of resource constraint. Barring technical breakthroughs which may alter this situation, PI texts will continue to be the most common form of II.

COMPUTER AIDED INSTRUCTION. The implementation of computer-aided instruction in the NAVEDTRACOM has been relatively small compared to other components of II. The cost of employing computers for the sole purpose of instruction has, until recently, been prohibitively expensive. In addition, the use of CAI has been validated for only a few, very specialized types of training. In the short time available for the study, a surprising number of CAI programs were identified. These are listed in table 9. While not exhaustive, this information gives an impression of rapid growth in this aspect of II for technical training.

It is difficult to identify all CAI delivery systems in the Navy because of management practices associated with procurement. Major systems are reported and carefully tracked within the NAVEDTRACOM. However, desk top calculators and training devices employing computers are procured and managed separately from large systems and are identifiable only through tedious examination of records and interpersonal contacts. A management information system which permits tracking of all CAI systems will soon be a requirement if duplication of effort is to be avoided and effective management control exercised.

It is likely that experimentation with CAI delivery systems, particularly for specialized types of training, will continue. However, it is unlikely that there will be widespread expansion of CAI or replacement of CI or CMI until software costs can be lowered significantly. At a time when hardware costs are dropping precipitously, software costs continue to be the limiting factor in any computer-based development.

It should be noted that the information contained in this section was obtained in a 4-month period. The data should be considered representative as an exhaustive survey was not possible. Similar analysis in other areas of training and education are required to have a complete picture of the extent of II in the NAVEDTRACOM.

TABLE 9. COMPUTER-AIDED INSTRUCTIONAL PROGRAMS PLANNED/IN PLACE IN NAVY TRAINING

CAI Identification	Training Use	Number of Students Stations	Locations	Remarks
TICCIT (MITRE/Hazeltine)	S-3A	Undetermined	North Island Cecil Field	In Use
EC-2/3 (Educational Computer Corporation's 2- and 3-dimensional panels with CRT)	AE	91	Memphis	14 systems under contract
	AS	103	Memphis	8 systems
	Marine	100	Camp Pendleton	27 systems
	Marine	60	Twentynine Palms	200 additional stations
	NAVAIR	Undetermined	Undetermined	
GETS (General Electric, computerized, self-contained, interactive training console)	TRIDENT (strategic Weapons Training)	15	Bangor	
	TRIDENT (Engineering Operations Training)	12	Bangor	
Device 20S17	OS "A" School	60	Undetermined	NTDS Training FY 84 Implementation
CT(O) CAI System	CT "A" School	15	Undetermined	Basic Communications and CT message handling
Not Designated	F-18	Undetermined	Undetermined	Planned for Future
Device 10H1	EW Operations and Maintenance	60-70	Corry Field	300 Learning Carrels will be under CMI

SECTION III

FACTORS AFFECTING THE EFFICIENCY/EFFECTIVENESS OF INDIVIDUALIZED INSTRUCTION

This section identifies and discusses factors which influence the effective development, delivery, and management of instruction. The analysis focuses only on those factors which can effect changes toward improving the efficiency/effectiveness of II in the NAVEDTRACOM. The present Navy II program is a massive undertaking. Although its full extent is difficult to document, its CMI component is the largest and most successful system of its kind in terms of numbers of students processed and numbers of courses resident in the system. It should also be noted that the Navy has consistently been in the forefront of the development and implementation of computer based instruction. Because of its visibility, the Navy program has received more than its fair share of criticism.

It has been demonstrated that II is as effective an instructional strategy as CI. Therefore, there are only two major relevant considerations for the evaluation of II: cost effectiveness and management effectiveness. The remainder of this section provides information bearing on these issues. Specifically, factors are identified which singly or in combination may impact on the cost or management effectiveness of II. Each factor is then discussed and specific illustrations of its effect on instruction are provided. The factors are arbitrarily grouped into those dealing with:

- organizational structure for II
- attitudes
- resources
- data bases
- instructor/manager training
- course administration.

ORGANIZATIONAL STRUCTURE FOR INDIVIDUALIZED INSTRUCTION

A primary factor in the efficiency of II is the organizational structure which has evolved to support its implementation in NAVEDTRACOM. An appropriate organizational structure is a necessary but insufficient condition to the effectiveness of an instructional system. Seidel and Wagner (in press) have suggested that desirable organizational characteristics associated with a complex innovation such as the large scale implementation of II include:

- a clear line of project control with congruent allocation of authority and responsibility
- frequent communication for monitoring expectations and understanding
- continuous communications mediated by the project manager.

Focus on these characteristics is particularly relevant to the analysis of the Navy organizational structure for II. The current command structure of NAVEDTRACOM was developed to support an instructional system which was and is characterized by the use of platform instruction and schoolhouse (decentralized) development and management of instruction. The implementation of II, the move toward centralized development of instruction, and increased centralized management of instruction via the computer, have placed additional emphasis on the need for integration and coordination across functional lines.

Figure 2 shows command and management relationships, CMI project management, and technical guidance relationships for CMI, a major delivery system for II. It is used here as an example of the complexity of organizational relationships which have developed to support this major facet of II. In addition to the various relationships depicted, each of the CNET Assistant Chiefs of Staff (ACOS) has responsibility for policy guidance in his respective area. Analysis of the structure depicted in figure 2 indicates the lack of a clear and unambiguous line of control and a potential for disruptions in communication and lapses in coordination.

During interviews conducted as a part of the present study, organizational structure was identified more frequently than any other factor as having a significant influence on the effectiveness of II. A major difficulty resulting from the current structure is that of establishing accountability for specific aspects of II. This difficulty was perceived to exist throughout NAVEDTRACOM except for ADP organizational units. Specific areas in which this difficulty was manifested and which are discussed in this report were:

- ambiguous policies for the selection of instructional strategies
- lack of standard policy for the use of course administration data available from the CMI system
- lack of coordination among activities responsible for centralized course development and resource allocation/acquisition
- inability to respond to requests for quantitative cost effectiveness/ evaluation data
- Lapses in responsibility and/or communication.

In addition, the lack of a single office/activity with responsibility for the integration and coordination of all aspects of II has contributed significantly to these problems. What now exists at CNET are offices with individual concerns for policy in instructional development and implementation, operational management of type training (technical, special, air), ADP support, or the management of centralized instructional development with regard to II. This decentralization of structure is also maintained at lower echelons of the command. This structure has promoted competition for resources, ill-defined boundaries of responsibility, and an occasional inability to respond completely and effectively to user concerns.

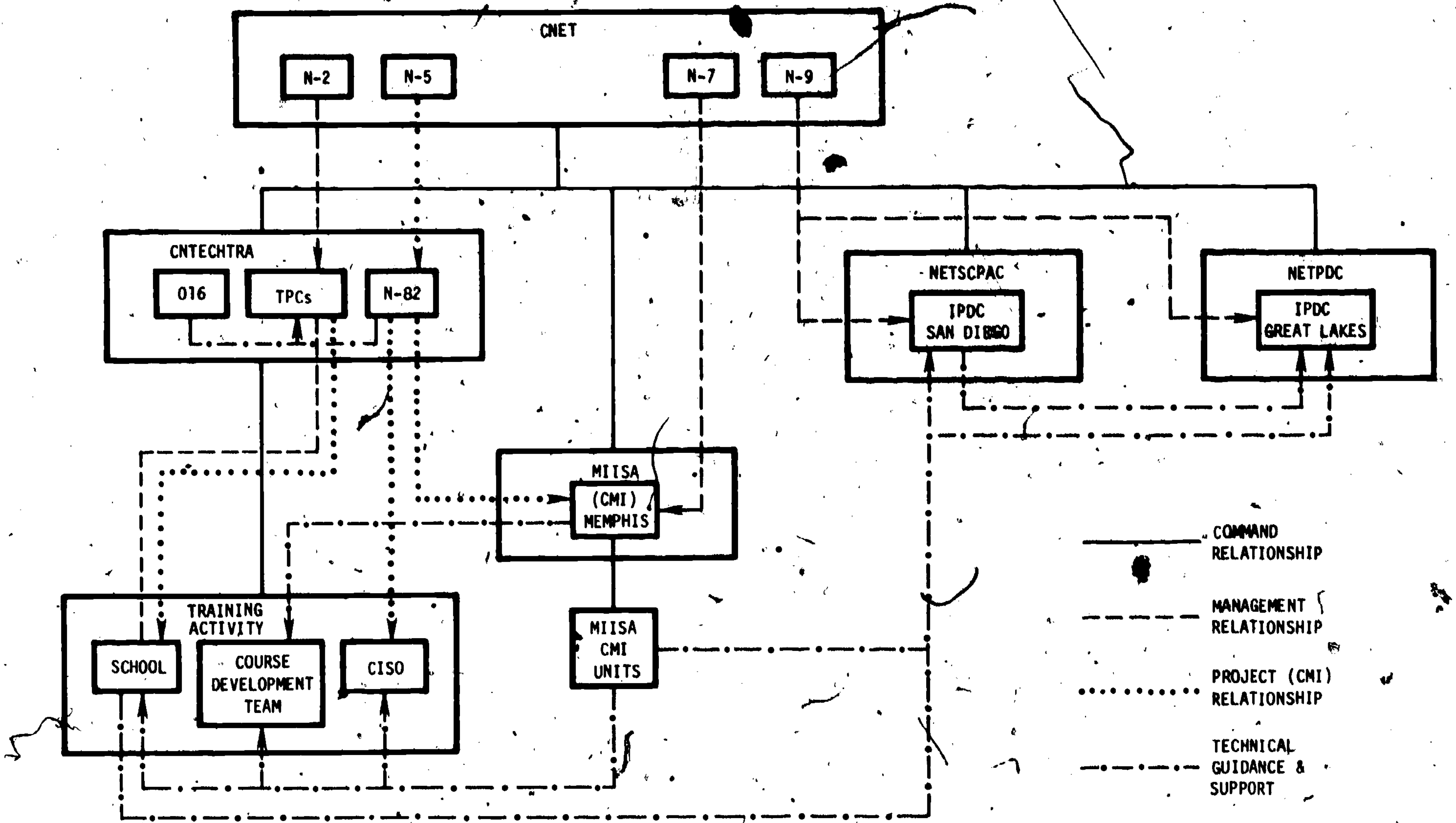


Figure 2. Command, Management and Technical Relationships in the CMI System

ATTITUDES

Currently, a significant number of Navy personnel have the attitude that II is ineffective and/or inefficient. In most instances, this negative attitude is not justified. Rather than focusing on specific problems such as the quality of instructional material, shortage of resources, or conflicts in policy, criticisms are usually nonspecific in focus.

Negative attitudes and resistance to change are likely to result from a lack of information, a failure to involve those activities required to implement the new program, and/or a lack of high level commitment to that program. Unfortunately, these effects tend to be generalized to all aspects/elements of the system rather than restricted to the specific components that may be ineffective.

This generalization of attitude often results from a lack of knowledge of the management structure or the failure to understand that many educational or instructional decisions are dictated by external constraints. In some instances there may be a perceived failure of the system to respond to expectations or requirements.

The discussions held with personnel involved in II indicate mixed perceptions of II. Some product users appear to be generally dissatisfied with the capabilities of graduates of II programs. Managers within the system, however, tend to view II as a satisfactory means of meeting increasing instructional requirements. Student and instructor attitudes range from total support to disenchantment. There is a small coterie vehemently opposed to II who are convinced that CI is the only form of instruction. However, the trend appears to be toward a more positive view of II as more experience with this instructional strategy is acquired.

Differences in attitude appear to reflect the degree of involvement with II. Moreover, many of the negative attitudes apparently reflect deeply held beliefs about the value of CI or an incomplete knowledge of what II is and how it operates. The essential point is that, regardless of cause, these perceptions do exist and must be addressed. Equally important is the identification of the conditions that can be addressed to ease the problem.

A number of factors were identified during interviews which appear to have contributed to the development of negative attitudes toward II. These are identified and briefly discussed below:

- <u>Confusion in terminology</u>. As indicated earlier, this is a pervasive factor. Clarity of terminology is essential to the establishment and communication of concepts, policy, and operations. The incorrect use of specific terms has led to misunderstandings and inappropriate criticism of the entire system.

Changing roles of instructors. The change from platform instructor to learning center supervisor (LCS) and from LCS to learning center instructor (LCI) has required considerable alteration to the functions of instructional personnel. Failure to recognize the functions of this new role, or a lack of training to prepare individuals to perform these functions, has been reflected in disaffections with the system.

Changing roles for students. The implementation of II has also changed the student's role. These changes have resulted from the requirement for more independent work, interaction with computers, and adaptation to different instructional environments. Combined with the changing quality of accessions and difficulties in identifying and providing appropriate incentives, these factors have affected student attitudes. It appears, however, that students can adapt more readily to II if it is encountered early in the training pipeline. Shifts between II and conventional methodologies may also result in student disorientation unless adequate preparation for these shifts is provided.

Impact of external constraints. Personnel who seldom come in direct contact with the development, delivery, and management of instruction generally do not have an appreciation of the constraints which operate on the system. Often, fiscal and management considerations are imposed which result in a less than optimal instructional program. Unfortunately, criticism is then leveled at the instructional program itself rather than at the constraints which have affected it.

Communication failures. This element is basic to the presence of negative attitudes about II and has also been discussed in the context of organizational structure. It is mentioned again in order to emphasize its importance to the overall effectiveness of II.

Changes in course content. Concurrent with the initiation of II, and/or the introduction of CMI, resource constraints have forced instructional managers to review what can reasonably be accomplished in training programs at all levels and to adjust programs accordingly. This sometimes results in graduates with different qualifications than previously produced. User failure to recognize that changes have occurred in instructional strategy and course content, with attendant implications for training responsibilities by on-the-job training (OJT), has resulted in some unwarranted criticism of instruction.

Measurement of performance. The present lack of data on the job performance and/or retention of knowledges and skills of school graduates has made it difficult to assess the validity of user criticisms of instructional programs.

- Understanding of instructional technologies. Much negative feeling toward II results from the perception that depersonalization of instruction and changes in quality of instructional material result from the use of the computer to manage instruction. Neither of these perceptions is accurate, but they do show a lack of understanding of the various aspects of II. Further, the requirements of computer based management for stringently specific information and relatively rigid operating guidelines may contribute to these perceptions since they might appear to be dictating instructional policy.

RESOURCES

Although training effectiveness and efficiency have already been discussed, it should be reemphasized that decisions made about instructional systems or programs always reflect a balance between these two concerns. Since research has shown that there is little or no difference in training effectiveness between conventional and individualized instructional strategies, the resource efficiencies that impact may be the most crucial element in the evaluation of II. Two points must be considered in the assessment of the efficiency of II:

- To date, research has concentrated on an expression of efficiency in terms of a savings of student time to complete specified material. The use of this single criterion as a benchmark may fail to take into account concomitant changes in curriculum material. Thus, available estimates of efficiencies may be confounded.

- There exist only a few relevant cost data bases for use in comparing the various economic elements of instructional programs; e.g., the CNET Resource Management System. Until more complete data resources are developed and maintained it will be difficult, if not impossible, to provide unambiguous estimates of cost efficiencies.

In addition to the purely economic basis for choosing an instructional strategy, there are several compelling reasons why more cost efficient training must be sought. For example, information presented in the previous section indicated a trend toward increasing complexity of training requirements with a concomitant requirement for increased training times. The combination of these trends with a requirement that training resources remain proportionately constant clearly establishes the need to identify more efficient means of training. Individualized instruction is one possibility for effecting these efficiency measures.

The decline in availability of training resources in general will continue to have an impact on specific training programs. The general reduction requires the reprogramming of available resources according to shifting or changing priorities. This often results in the development of adversary roles among training programs, courses, and systems as they compete for these resources. The existence of this competition implies that those units that can justify expenditures most effectively, while at the same time receiving active support from policy making personnel, will incur the least negative impact on their programs. As has been discussed previously, an attitude of total commitment for II programs is not currently perceived to exist. The data bases from which justification evidence could be compiled is fragmented and incomplete.

The appropriate method of assessing the efficiency of II is through life cycle costing (see appendix B). Unfortunately, like any high cost investment, these life cycle estimates are subject to events which may affect the accuracy of the initial estimates; e.g., the introduction of new technology. The failure to apply an appropriate costing model or to take into account external events operating on the evaluation may result in inappropriate or inaccurate data.

Another factor which affects the relationship between resources and II is the influence of external requirements or decisions on instructional issues. For example, external requirements to justify particular expenditures or to employ a particular instructional strategy may preempt the following of prescribed ISD procedures. Thus, optimum education/training programs may be made subservient to resource allocations. These external considerations also affect the strategies by which claims are made for resources.

A final general issue which affects allocation of resources is grounded in the changing nature and qualifications of the student population to be trained. The decrease in the total base population from which recruits are taken, the increasing numbers of women being trained, and the lower entrance level skills of recruits will assume more and more significance in the allocation of resources. Additionally, this set of circumstances may impact directly on selection of strategies or delivery systems and, thus, indirectly on resource use in operating these systems.

Clearly, the issues are complex and interactive. They are cited here as a basis for the interpretation and evaluation of other more specific findings. Several specific observations related to resources follow:

1. Increasing instructional requirements and decreasing resource availability have provided an impetus for the continuing development of innovative and efficient instructional strategies and delivery systems.

2. There is apparently a satisfactory level of resource availability for ADP support requirements, particularly in the hardware area. Capability for CMI expansion, for example, exists to levels that should accommodate requirements for at least the short term.

3. A primary result of the reduction in resources has been the reduction of support services at the schoolhouse level. This reduction in services, while detrimental to all programs, is particularly disruptive to those courses using II as an instructional strategy. For example, in numerous instances instructors are forced to assume responsibility for support functions. For II courses, where the original instructor complement was established on the basis of past estimates of student/instructor ratios and average periods of instruction, this added responsibility may increase the workload to critical levels. During peak loading periods, the additional support requirement may

necessitate cancellation of leave or other actions that will affect the morale of the instructor/management staff and, ultimately, impact on instructional quality.

The shifting of responsibilities and duties among schoolhouse personnel makes it difficult to maintain an accurate breakout of labor. Further, the disproportionate impact of resource cutbacks on support activities may precipitate a circumvention of the manpower accounting system in the belief that if such billets were identified as being filled by instructor personnel, the instructor billets would be perceived as being unnecessary and would eventually be taken away. This practice, unfortunately, has the direct negative impact of reducing the credibility of the manpower reports coming out of the instructional environment.

4. Significant waste of resources is occurring as a result of an inability to integrate the ISD process and the POM/budget cycle. In the implementation of II, the lack of coordination between course development and the POM cycles can be reflected in several specific ways. For example, there may be discrepancies between course development and ADP hardware acquisition or between course facility requirements and physical facility renovation budget insertions. The potential extent of this problem can be appreciated from a recent estimate that over $200K was expended on equipment acquired but not utilized at three NAVEDTRACOM locations during an 18-month period.

5. There is currently a widely held perception by lower echelon activities that there is a lack of management support for II programs. This perception is at least partially based on the low priorities assigned for resource support of those component systems that are associated with or supportive of II. This concern also extends to personnel support.

DATA BASES

There are three primary areas in which management information is required for the operation, management, and evaluation of any instructional system. These are course administration data, cost data, and training effectiveness information. Course administration data are inherent in the delivery of instruction. They include planning and status data at higher levels of management as well as specifics of course administration and student performance at the schoolhouse level. Cost data may be categorized into development costs and operational costs and include those costs associated with the direct support of the instructional program by other agencies; e.g., computer support. Training effectiveness information may reflect the degree to which a course has met its training objectives (internal evaluation) or it may reflect the degree to which course objectives are related to performance requirements in the Fleet (external evaluation). Various aspects of the above data bases can thus be combined to address questions of efficiency and/or effectiveness. The following paragraphs provide a brief overview of the current status of data bases available for the assessment of II.

COURSE ADMINISTRATION DATA. There are considerable course administration data available on all technical training courses in the various files of NITRAS. While a great deal of detailed information is available through this system, it provides only a very broad categorization of courses in terms of II.

The CMI system maintains additional administrative data on those courses presently on the system to the level of individual student responses and provides for the management of a student's progress through the course. This system also provides a series of reports appropriate to the overall management of II at the schoolhouse. Additional management reports are being developed on a centralized and individual basis as needs are identified. It may be appropriate at this time to conduct a requirements analysis to preclude duplication of effort, to insure that appropriate management tools are available, and to identify any additional training needs regarding the use of available information.

No single data base was identified which permits either a complete reporting of status or the evaluation of computer based instruction in the Navy. Such systems have been identified (section II) but have been associated with the research and development cycle of training device procurement making it difficult to track and evaluate their operational use.

COST DATA. Data which permit a comprehensive cost benefit analysis are not available. The CNET Resource Management System (RMS) can provide operational costs of courses, and the acquisition and operations cost of the hardware supporting CMI are available. However, unambiguous course development costs are not available. Further, a meaningful comparison of II with CI and CMI with IMI in terms of efficiency will require specific cost data associated with instructional development and course operation.

The only cost comparisons of II and CI have been in terms of projected savings in student time. It has been found that considerable savings are obtained through II. It was noted earlier that portions of these savings may be attributed to changes in curriculum, thus confounding any generalizations about II efficiency. It has been suggested (Orlansky and String, 1979) that a 10 percent increase in efficiency is realized when computer management is added to a well designed individualized course. Clearly, quantitative response to inquiries regarding the efficiency of II are not possible at the present time without the development of appropriate data bases.

TRAINING EFFECTIVENESS DATA. The training effectiveness of II has generally been assessed by comparing end of course achievement scores of students in II and CI courses. It is generally held that II is at least as effective as CI in those terms. In essence, this amounts to an internal evaluation or an assessment of the degree to which instructional strategies are equivalent in meeting course objectives. Such evaluations are being conducted by schools on a continuing basis.

The development of a comprehensive/standardized data base by CNET for external evaluation is currently underway. However, there currently exists no data base which permits a direct assessment of the effectiveness of II on a command-wide basis.

INSTRUCTOR/MANAGER TRAINING

The implementation of II in the NAVEDTRACOM has had a profound influence on the role of the instructor and manager in the learning process. In II, the proportion of instructor effort devoted to teaching is less than that devoted to the roles of counselor, classroom manager, automatic data processing technician or master-at-arms. However, course-related activities such as instructional development or test and evaluation have changed. These changes dictate the need for effective preparatory training in the unique aspects of II.

In discussing the impact that training of instructors and managers has on the effectiveness of II, two additional points should be borne in mind:

- The role of the instructor in II is still evolving and the best utilization procedures, optimal assignment policies, or the extent of various kinds of training that should be provided have not been established. Accordingly, it is important that provision be made for investigation in these areas to continue.

- Training in II should not be limited to instructors. There is ample evidence that the requirement for training in the delivery aspects of II extends to all levels of management. Those individuals in administrative and/or managerial roles should also be trained in the optimal application of II to the learning process.

During the course of this study effort, specific areas of concern related to the training of instructors/managers were identified. These problem areas are discussed below.

1. Although recognized as important, little in the way of tangible support has been provided instructor training for II. This lack of support is reflected in low priorities assigned to instructor/manager training.

2. There is little standardization among training activities in training provided for instructors assigned to II programs. Some training activities have based their programs on the assumption that an II instructor should be as broadly trained as possible and require that all available training courses be taken. Other activities require only completion of the LCI course now offered at the various IT schools. In either instance, OJT may be provided. Neither of these approaches is optimal; however, one of these may be inefficient and the other ineffective.

3. There is a widespread perception that the LCI course, as currently configured and administered, is of little value to potential instructors in the delivery of II. Training needs of the LCI have not been adequately identified. The course itself, intended as a 5-day individualized course of instruction, normally takes only 3 days. This is not considered sufficient

to provide the breadth of information that is required for skilled performance in a learning center. It is questionable that OJT can make up for these deficiencies.

4. In almost all training activities, the effects of a continuous and sometimes substantial pressure on the instructor to move students through the program, using techniques with which he may not be totally familiar or comfortable, can be seen in the behaviors and attitudes of the instructor population. If these conditions persist, and as time in job increases, anxiety, alienation, and/or boredom levels may increase. Several training activities control this effect by rotating instructors among instructional and support functions.

The essential point here is that this type of problem is being handled on an individual basis with little or no coordination among training activities or even among schools at the same activity. Despite these difficulties, individual schools seem to be meeting their own unique instructor training requirements through OJT. It is apparent that both the knowledge and the willingness to address training problems is present within the instructor community; however, the current piecemeal approach is not the most efficient way to apply available skills and knowledges.

COURSE ADMINISTRATION

The factors discussed in this subsection are related to various aspects of course administration.

TESTING POLICIES. The total effectiveness of II is influenced by the comprehensiveness of the evaluation programs associated with it. Students presently enrolled in courses managed by CMI are limited to a multiple choice format, hence, restricting evaluation to the assessment of retention via recognition. Specifically, this policy has restricted flexibility in developing item alternatives in both progress testing and remediation testing. It has not generally been used to assess the recall of material, although this may be possible through the application of ingenuity in the use of multiple choice formats. However, several instances were observed in which initiatives were being taken at the schoolhouse to provide for testing via recall using additional written and oral examinations. In addition, alternatives to the current hardware limitations associated with student input are being evaluated as a part of an overall systems analysis of delivery strategies.

PREDICTED COMPLETION TIMES (PCT). The purpose of PCTs in II is to provide guidelines for the assessment of individual student progress by allowing for monitoring of progress during the course and by establishing a student's class ranking. The use of PCT to influence the progress of a student is not completely consistent with an idealized model of II but is necessary and consistent with the requirement that the Navy train its personnel in the most efficient manner. Because it is a major basis for evaluating progress the average accuracy of predictions and the specific components in the prediction equation are critical considerations. Several respondents indicated that the level of accuracy in individual predictions of the PCT was unacceptable. At least a portion of this inaccuracy was due to the fact that reading comprehension was not included in the PCT equation until recently. Since the courses are verbally loaded this discrepancy was to be expected. In addition, what appears to be slavish adherence on the part of some activities to the use of the PCT as a point estimate, instead of an average which includes a range of acceptable values, appears to have complicated the problem. Further, the lack of uniform application of the PCT across activities makes direct comparison of various evaluation data difficult.

COURSE LOADING. Given the availability of related support services; e.g., billeting, the momentary student capacity of any course is determined by the number of classroom seats or carrels. Thus, both conventional and individualized courses suffer the same stresses associated with an inability to level load. The perception that individualized courses would somehow act to minimize the impact of uneven loading has proven to be inaccurate. The observable effects from aperiodic loading in II include:

- high student/instructor ratios
- double shifting at peak loads
- increased time in queue
- disruption in support areas--messing and billeting
- an increased sense of depersonalization
- decreases in motivation of students and instructors
- increased difficulties in tracking students.

HARDWARE. For the most part, ADP equipment associated with the management of II in CMI is very reliable and meets system specifications. Figure 3 shows a summary of a typical day's interaction with the system. Figure 4 shows CMI central system availability over a selected time period. However, several considerations with respect to hardware are appropriate.

State-of-the-art technology is rapidly progressing and elements of the present system are becoming obsolete. For example, alternatives to the present paper input system need to be identified and evaluated. The lack of flexibility in the system's capability to accept student responses has been addressed in a previous section. Decision guidelines for the centralization or decentralization of present and future system configurations also need to be established. Initial steps are being taken by CNET to accomplish these requirements.

The capacity of the present system is more than adequate given the original and modified implementation schedule. However, changes to these schedules and the increased demand for on-line interactive delivery of instruction requires an in-depth analysis of the present and future potential of distributive processing.

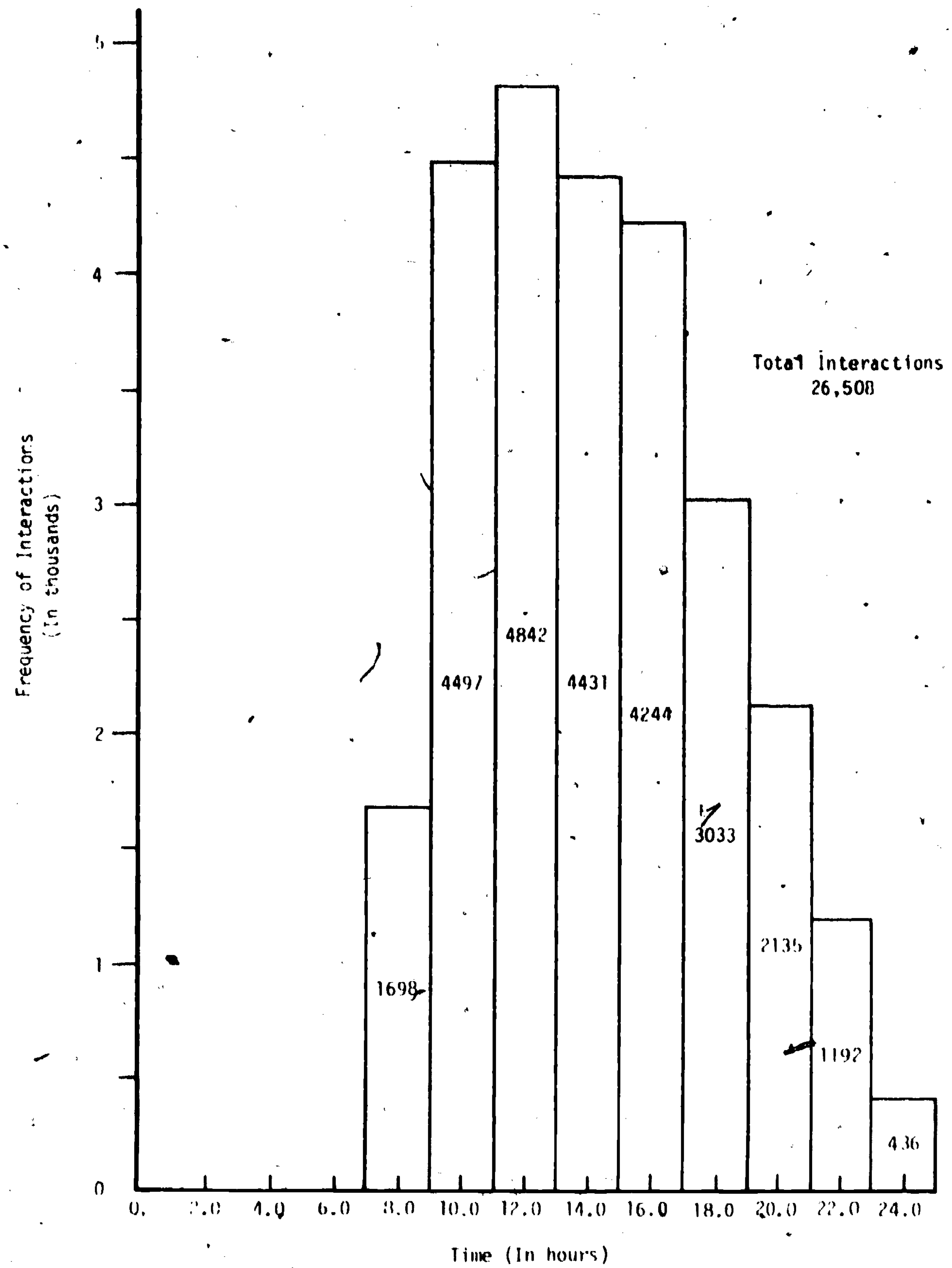


Figure 3. Typical Frequency of Trainee Interactions with CMI for Nine Courses in Session on 20 August 1979 for 24-hour Period

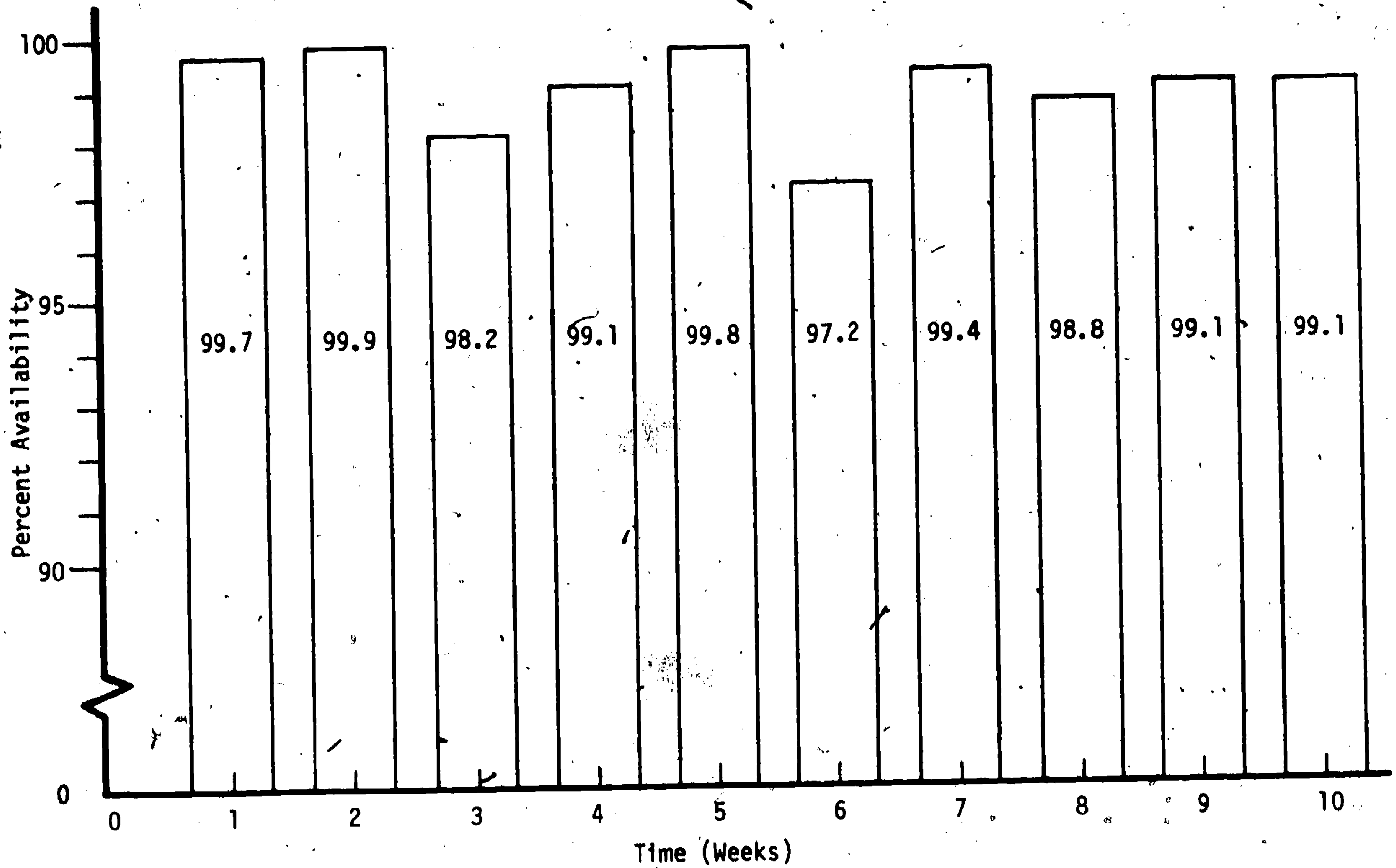


Figure 4. Percent Time CMI Hardware Availability for Period 1 July to 10 September 1979, MIISA, Memphis, TN

The only difficulties associated with the present hardware system are in the transmission of information. This occurs primarily at a single location and is not considered a major problem. It is anticipated that the problem will be solved by advances in technology or decreases in cost of alternative transmission modes.

MANAGEMENT INFORMATION SYSTEM REQUIREMENTS. This study identified no management information systems capable of producing all information required for an analysis of all aspects of II. There is a need to determine whether the current reports available through the CMI system represent an optimal response to the information requirements of the various agencies of the training community. There is little doubt that sufficient data is or can be made available. Figure 5 provides an indication of the variety of reports available from CMI and indicates levels to which they might be applicable. However, these reports do not reflect a requirement to integrate, for higher levels of management, information on all aspects of II in the technical training environment. Also, the figure does not indicate the information requirements for the coordination of instructional, budgetary, and planning functions.

COURSE ARTICULATION. A common difficulty which has also occurred with respect to the implementation of II is the development of courses without sufficient concern for integration with other courses in the training pipeline. Specifically, school personnel have indicated that in many instances follow-on schools and fleet recipients have not recognized that course content has been modified and that the responsibility for aspects of instruction have shifted. This has produced unwarranted criticism of the instruction being offered at the school.

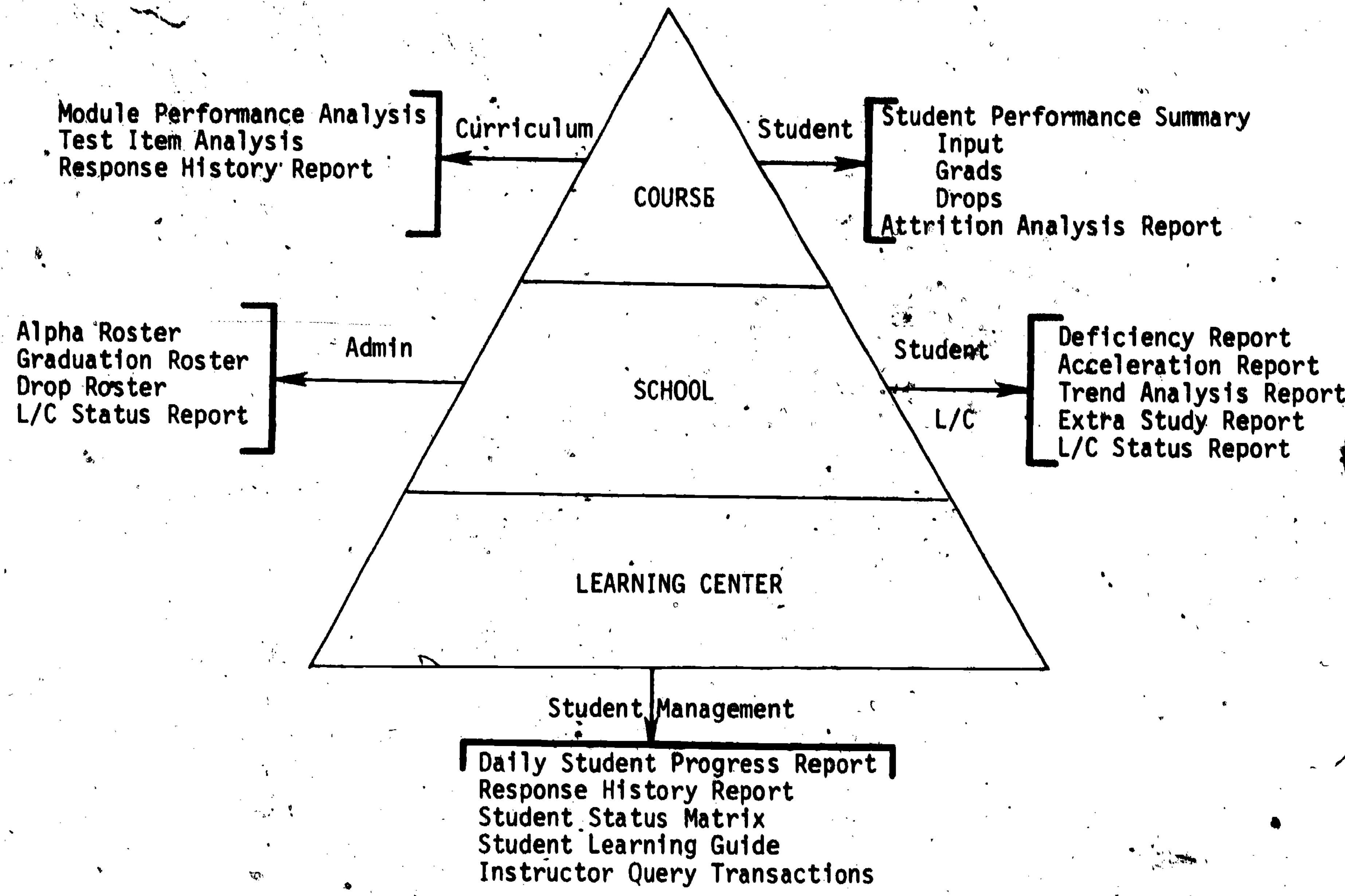
A problem which may be unique to the integration of II courses with conventional courses is the disorientation associated with the movement of students between these radically different instructional strategies. This disorientation may be reflected in both instructional and noninstructional areas either of which will result in decreases in training efficiency/effectiveness.

The specific impact of shifts between II and CI on the planning for, and access to, schoolhouse resources is unknown at this time. However, it appears that this is an area which has been ignored and which, if analyzed and controlled, may offer the potential for significant cost savings and training efficiencies in the training pipeline.

STUDENT ADMINISTRATION

This section describes the impact of administrative factors specifically related to students.

HOLDING TIME. There appears to be no consistent policy with regard to the use of students during holding periods. The length of the holding period is directly related to the peak loading of courses. There is little information which permits an analysis of the direct impact of holding time on the effectiveness of II. The type of problem associated with holding time is related to where that time occurs in the pipeline. Students placed in a holding



Source: Chambers (1979)

Figure 5. CMI Management Levels and Available Reports

status prior to their initial technical training have shown motivational and attitudinal problems. This effect may be compounded by the transition from a highly structured training environment (recruit) to the more permissive environment associated with II. Technical training students who are placed in a holding status between their initial technical training course and their follow-on training may also experience motivational and attitudinal difficulties but, in addition, may experience some deterioration of knowledge/ skills through disuse.

Several commands have developed innovative approaches to the use of holding time:

- use of advanced students as instructors in remedial programs
- temporary assignment to fleet units
- assignment to remedial programs
- use of time for GMT.

The capability to apply these innovative approaches is dependent upon location and environment. However, they are examples of what can be done to increase the effective use of holding time.

REMEDIATION. There are two forms of remediation which may impact on the effectiveness of training. The first is Basic Skills remediation which most often occurs early in the training process. This form of remediation generally involves reading skills and, perhaps, basic mathematics; e.g., the Academic Remedial Training System (ARTS). Improving Your Navy Reading Skills (Curry and Kincaid, 1979) identifies a goal of ARTS as raising the reading ability of recruits to a 6th grade level, the minimum for adequate understanding of recruit training materials. This does not imply a capability to enable these people to understand more technical training materials. The second form of remediation may involve course related remediation which is more specific in content and directed toward the accomplishment of course objectives. It can be expected that as the quality of accessions decreases there will be requirements for increases in both forms of remediation. Future policies dealing with entry level requirements, waivers, and length of programs must take these factors into account.

An issue related to remediation is the policy of accounting for student time when in a remediation status. In some instances, all student time is reflected in the accounting thus inflating time in course averages. In others, student remediation times are not a part of the course completion time thus lowering average course completion times. The lack of consistent policy makes comparability of course efficiencies difficult.

With regard to CMI, policies for the provision of remediation internal to specific courses are perceived to be somewhat inflexible and driven by noneducational factors. The content of remediation may be affected by the lack of resources to develop desirable remediation materials. The programming requirements associated with the delivery of remediation on CMI may create conditions which promote a standardized system but at the same time these may not be suitable for all courses.

If recruitment and assignment policies continue to be established independently of training resources and capability considerations, these problems will become more pronounced.

INCENTIVES. The use of incentives as an influencing factor on the efficiency of II is related to the use of PCT in managing the progress of students in courses. The comments made in the section dealing with PCT are generally applicable here.

There appears to be little consensus among school personnel about what constitutes the most appropriate incentives for early course completion. Time off, extra leave/liberty, and letters of commendation are in general use in NAVEDTRACOM but demonstrate varying levels of success. It may be that the effectiveness of the incentives available to NAVEDTRACOM is directly related to the fact that such incentives in other environments (nonmilitary) are seen as rights and not privileges. Further, circumstances beyond the control of NAVEDTRACOM (geographic location, proximity to family, extracurricular activities) may produce significant and confounding effects on incentive effectiveness. The kinds of incentives offered in the schoolhouse cannot combat the disillusionments and low morale stemming from unrealistic expectations about military life. Efforts to determine the relative effectiveness of various types of incentives are just beginning, but the results of these efforts will still have to be applied in the atmosphere of reduced resource support for training.

HOUSING AND MESSING. Like instruction, housing and messing availability are significantly affected by the peaks and valleys of course loading, resource allocation, and physical facilities limitations.

Individualized instruction, because of its flexibility in start and finish times, may place added management duties on the administrative command to ensure minimal disruption to the instructional process. The following is a list of potential problem areas identified:

1. Assignment of berthing spaces may not conform to shift assignments in multiple shift courses.

2. Mess hall and other base facility hours are not always coordinated with shift assignments.

3. Students may be required to change berthing even though their next school assignment is colocated.

4. Because of increased difficulties in tracking students, additional regulations may be required to maintain good order and discipline. This problem is compounded by the loss of support services/instructors.

Major differences were noted in the manner in which the authority/responsibility for these functions was exercised. In some instances, the Base Command had overall responsibility for berthing and messing. In others, the School Command performed these functions. Local circumstances dictate the relative efficiency of these two approaches.

INSTRUCTOR ADMINISTRATION

This section identifies two factors related to the role of instructors in course administration which have not been dealt with in previous sections.

PLOWBACK POLICY. Presently, graduates of "A" schools are being used to perform instructional or instructional support roles. These personnel may be in a "hold" (medical, legal, etc.) status or reassigned directly to "A" school for an 18 months instructional support role. There are a limited number of such billets. Individuals filling these billets perform administrative functions within schools and generally supplement reduced school staffs.

This program is scheduled for termination in FY 81 and the question of plowback replacements has not yet been resolved. If no replacements are assigned, increased stress on assigned personnel and additional fractionation of instructor duties creating potentials for inefficiencies in the delivery of instruction can be expected. With the loss of this support to the instructional program, measures will have to be taken to replace this support if the current quantity and quality of instruction are to be maintained.

COLLATERAL DUTIES. Discussions in several previous sections have alluded to the increased requirements being placed on instructors. These include:

- General Military Training
- Administrative Support
- Watchstanding
- Master-at-Arms (Barracks Watch)
- Course Development
- Academic Review Board
- Disciplinary Boards.

The overall effect of these additional duties is to extend the normal workday, eroding what was perceived to be a benefit associated with instructor duty. This erosion makes instructor duty less desirable. Collateral duties are to be expected on a short-term basis; if they occur on a continuing basis they may have a deleterious effect on instructors in an II environment. In this environment, instructors are required to spend longer periods of time in the instructional setting with what are perceived to be less personally satisfying tasks than in CI.

Several activities have suggested that this additional load adds to the potential stress on instructors as previously noted. In II this has led to greater "fatigue" and alienation effects. This is reflected in decreased positive student-instructor relationships, stereotyped responses to questions, and, at some activities, provision for rotation between instructional and support duties on a regular basis. The instructor training course under development may provide at least a partial solution to these problems.

SECTION IV

CONCLUSIONS AND RECOMMENDATIONS

This section contains conclusions concerning general factors which may influence Navy technical training. It also provides recommendations relevant to the improvement of II in the Navy.

CONCLUSIONS

Available data strongly indicate the continued use of II as an instructional strategy in Navy technical training.

The remaining conclusions in this section are intended to convey a sense of the forces that are likely to be operating on all Navy technical training and, hence, shaping its direction. They are organized into the general categories of training effectiveness, instructional strategies, instructional management, manpower availability, and program administration. They are presented in no particular order of importance; however, their interactive characteristics should be carefully noted.

Previous sections have identified a number of specific factors which may impact on the efficiency/effectiveness of II. Discussions of these factors have identified specific problems and in many instances suggested solutions.

TRAINING EFFECTIVENESS. There will be a continuing emphasis on the need to achieve training effectiveness within limited resource availability. This emphasis is currently reflected in

- requirements to develop management information systems for the evaluation of training effectiveness and to conduct effectiveness studies
- requirements to develop and implement procedures and techniques for the implementation of recommendations stemming from internal and external evaluations
- requirements to adapt and integrate new educational and hardware technology in current and future training systems.

INSTRUCTIONAL STRATEGIES. The use of II can be expected to continue and expand in the Navy as increased emphasis is placed on training efficiency. There is evidence that pipeline training times are lengthening due to increasing complexity of technology. At the same time, resource support for training is not expected to keep pace with resource requirements. Thus, efficiency in training operations becomes a paramount concern. Since II reduces time in training with no apparent loss in training effectiveness, its continued use may be mandated by necessity.

INSTRUCTIONAL MANAGEMENT. The management of instruction via CMI will play an increasingly important role within the NAVEDTRACOM. Computer management will be necessary to support the anticipated growth in II programs. Increasing capabilities of "mini" and "micro" computers, significant advances in software, and decreasing costs of hardware suggest that changes in the configurations of computers supporting instruction can be expected. As these new systems are introduced, policies and decision algorithms regarding the mix of centralized and decentralized computer systems for training support will have to be established.

MANPOWER AVAILABILITY. The size of the population from which Navy enlistees are drawn is declining. At the same time, there appears to be a general lowering in the quality of these accessions. Unless acquisition policies change drastically, these trends will continue to have a significant impact on training policy and operations. That is, incoming personnel are likely to require more instructor contact and/or remedial instruction to prepare them for job-related training. This expansion of II may include requirements for

- provision for more flexibility in training and testing
- an expansion of remediation programs to include job-related academic material
- increased emphasis on individualized student study programs, including study skills.

The requirements above have implications for policies related to administrative hold times, management of berthing and messing, and most importantly, the cost of training.

PROGRAM ADMINISTRATION. Given the trends toward fiscal austerity and increasing competition for available resources, education and training requirements will have to be carefully documented and justified. Specifically,

- a closer coordination of the management, development, delivery, and support aspects of the training pipeline will be necessary
- economic models appropriate to various types of instructional decisions will have to be developed
- cost data bases and management information systems appropriate to training efficiency analyses and the production of standard reports will have to be developed and/or refined.

RECOMMENDATIONS

Recommendations for the improvement of II in the Navy and accompanying rationales are presented below. They are based on study findings and assume that II will continue to be used as an instructional strategy in Navy technical training.

1. Establish a single office/activity with responsibility for all aspects of the integration and coordination of II including instructional development and implementation, operational management of type training, management of centralized instructional development, and ADP support. Alternatives to be considered in implementing this recommendation include:

a. establish the responsibility with the Deputy Chief of Naval Education and Training or with a staff code reporting directly to him

b. appoint a "steering committee" composed of major participant activities, chaired by a nonparticipant as in 1a above

c. assign the responsibility to an operating Assistant Chief of Staff (ACOS) within CNET.

It is further recommended that an interim office be established to perform this function until such time as the recommendation can be implemented on a permanent basis.

2. Develop an information package to be presented to all NAVEDTRACOM and major fleet activities which would communicate the rationale, philosophy, and implementation procedures and policies associated with II. Examples of specific topics to be included in this package are

- command and organizational relationships
- definitions of terms
- feedback processes
- external constraints.

3. Initiate and support an effort to determine the relative effectiveness and efficiency of II for different kinds of training tasks and ability levels of trainees.

4. Ensure the use of standard II terminology throughout the NAVEDTRACOM. These terms and definitions should make clear the distinction between instructional strategies, instructional management systems, instructional delivery systems, and instructional media. Until such usage is generally prescribed and accepted, confusion, complaints, and inappropriate criticisms may be anticipated.

5. Develop and implement criteria for selecting among alternative instructional strategies, instructional management systems, and/or instructional media.

6. Ensure that the training pipeline for II instructors includes materials appropriate to the role of the Learning Center Supervisor/Instructor. A portion of this instruction may be devoted to material developed for 2 above. In addition, this instruction should include topics such as

- computer operation in II
- testing limitations/alternatives in II
- student counseling
- course administration procedures

- progress monitoring
- coping with stress
- use of CMI reports.

It is further recommended that these materials be developed and implemented on an interim basis until such time as the instructor training curricula being developed at Naval Education and Training Support Center (Atlantic) becomes available. Consideration should also be given to greater standardization of current instructor training offerings.

7. Develop and implement an II management course for all training administrator and school/course management personnel. A portion of this course may be devoted to material as described in 6 above. Emphasis should be placed on topics of particular concern to management.

8. Conduct a comprehensive survey to establish the types and extent of II in use throughout the Navy. Categories of instruction in this analysis should be based on the distinctions established in this report.

9. Examine the desirability of providing preparatory materials in the use of computers in instruction for students and/or instructors. If determined to be appropriate, such programs might provide portions of the interim training for instructors recommended in 6 above. Further, if such training is deemed desirable, available "off the shelf" packages should be examined for possible adoption.

10. Establish a program to identify incentives and/or procedures which act to improve student and instructor performance in an II environment. Concurrently, conduct a cost/benefit analysis of promising programs.

11. Assess the relative cost benefits of alternative hardware systems for CMI. Considerations of alternative student input devices and centralized versus distributive processing should be included in this assessment. Initial efforts in this area are underway.

12. Develop procedures to locate, acquire, and/or develop cost data bases necessary for the conduct of the cost effectiveness analyses of alternative training systems and apply the approach proposed in appendix B of this report. Apply this data as available to cost effectiveness comparisons of training approaches of interest.

13. Identify those data elements found in the NITRAS, Navy CMI, training device, and other management information systems which will support the monitoring and management of II in the Navy. Develop procedures to acquire and maintain this information.

14. Develop and implement a management information system for the management of instructor personnel at individual training activities. Such a system should reside on currently available computer systems and should include data elements such as

- instructor qualifications
- past and present instructor assignments
- rotation assignments
- collateral assignments
- training assignments.

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APPENDIX A

LIST OF COMMANDS AND ACTIVITIES VISITED/CONTACTED

U.S. Army

Army Research Institute, Alexandria, VA
Signal School, Ft. Gordon, GA
Training Development Institute, U.S. Army Training and Doctrine Command, Ft. Monroe and Ft. Eustis, VA

U.S. Air Force

Air Training Command Headquarters, Randolph AFB, TX
*Human Resources Laboratory, Lowry AFB, CO
Office of Scientific Research, Bolling AFB, Washington, DC
Pilot Instructor Training School, Randolph AFB, TX
3270th Technical Training Group, Lackland AFB, TX

U.S. Navy

Aviation Mechanic "A" School, NAS Memphis, Millington, TN
Aviation Fundamentals (P) Course, NAS Memphis, Millington, TN
Avionics Technician "A" School, NAS Memphis, Millington, TN
BE&E School, NTC Great Lakes, IL
BE&E School, NAS Memphis, Millington, TN
BE&E School, NTC Orlando, FL
BE&E School, NTC San Diego, CA
Chief of Naval Education and Training, NAS Pensacola, FL
Chief of Naval Technical Training, NAS Memphis, Millington, TN
Instructional Program Development Center, NTC Great Lakes, IL
Instructional Program Development Center, NTC San Diego, CA
Instructor Training School, NAS Memphis, Millington, TN
Management Information and Instructional Systems Activity, Pensacola, FL
Naval Air Technical Training Center, NAS Memphis, Millington, TN
*Naval Education and Training Support Center, Atlantic, Norfolk, VA
Navy Personnel Research and Development Center, San Diego, CA
Office of Naval Research, Arlington, VA
Propulsion Engineering (Basic) School, NTC Great Lakes, IL
Radioman "A" School, NTC San Diego, CA
Service School Command, NTC Orlando, FL
Service School Command, NTC Great Lakes, IL
Service School Command, NTC San Diego, CA

*Contacted

APPENDIX B

A MODEL FOR ECONOMIC ANALYSIS OF INSTRUCTIONAL STRATEGIES

At some point during the course development process, the educator must choose between individual and group strategies, between the various media, and between instructor and computer management. It is likely that several different kinds of courses could train a given set of tasks with equal effectiveness; i.e., the degree of training, as exhibited in end of course tests, would be equal for different kinds of instruction. Consequently, the decision on the kind of course to be developed must depend on some criteria other than effectiveness. Given such choices, DOD policy dictates that resource costs will be the criteria; the alternative with the lowest life-cycle cost will be the one selected for implementation.

OVERVIEW OF "COST-EFFECTIVENESS" ANALYSIS

The appropriate approach to use in comparing alternative training systems, in order to determine which would be least costly, is "cost-effectiveness" analysis. Cost-effectiveness analysis is the most widely used term but it is synonymous with "economic analysis," the Office of Manpower and Budget's "cost comparison analysis," the corporate financier's "capital budgeting analysis," and the defense analyst's "life-cycle costing." Regardless of name, the methodology remains essentially the same and the decision-making solutions are identical. "How-to" instructions abound--DOD Instruction 7041.3 "Economic Analysis and Program Evaluation for Resource Management" and the Defense Economic Analysis Council's "Economic Analysis Handbook" provide general instructions for cost-effectiveness analyses. TAEG Report No. 55, A Guidebook for Economic Analysis in the Naval Education and Training Command, provides more detailed instructions, while appendix B to TAEG Report No. 16, A Technique for Choosing Cost-Effective Instructional Delivery Systems, contains an ADP cost model which would be most helpful when conducting training cost-effectiveness analysis. In the final analysis, these approaches are nothing more than finding the cheapest way to do something.

In general, the cost-effectiveness analysis involves summing the relevant costs for each alternative and awarding the decision to the least costly option. The issue of relevancy is paramount. Costs are relevant only if they will occur in the future (i.e., are not yet "sunk" and if they are variable) (i.e., vary among the alternatives being considered).

For example, assume that a new course is being developed to train electronic switchboard operators. The educator has determined that three training alternatives will do the task equally well. They are a computer managed self-paced course, an instructor managed self-paced course, and a course using conventional instruction. The conventional instruction would use lectures and texts, while the self-paced instruction would use programmed texts. The cost analyst's task would be to look at each individual productive resource and to estimate the amount that would have to be purchased or diverted from other organizations in order to accomplish the training mission. A hypothetical summary cost sheet for the above three alternatives appears in table B-1.

TABLE B-1. HYPOTHETICAL COST-EFFECTIVENESS STUDY OF THREE ALTERNATIVE SWITCHBOARD OPERATOR COURSES

Resource Category[1]	CMI Self-paced	IMI Self-paced	Conventional Instruction
	Life-Cycle Relevant Costs for Three Training Systems (millions $)		
I Course Development	$ 4.3	$ 4.0	$ 3.0
II Course Operation			
A. Student Compensation	21.0	24.0	30.0
B. Instructor Compensation	.7	.8	1.0
C. Classroom Modifications	.3	.1	0
D. Supplies Equipment			
Conventional Texts	0	0	.1
P/I Texts	.1	.1	0
Computer	.2	0	0
Total	$26.6	$29.	$34.1

[1] Categories are adaptations of categories found in the TECEP cost model, appendix B to TAEG Report No. 16, A Technique for Choosing Cost-Effective Instructional Delivery Systems.

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Included in the hypothetical analysis are only those costs which vary between alternatives. For example, since health care, base support functions, personnel support activities, student travel, and other similar costs are not included, it must be assumed that they apply equally to the three alternatives being evaluated. If in reality such expenditures did vary across the alternatives, they would then have to be included in the study. In this example, the CMI system has the lowest cost and should therefore be chosen for implementation.

PROBLEMS AND RECOMMENDATIONS

RAW COST DATA. Raw cost data is generally available for all categories except course development costs. Until the recent advent of the IPDCs, no data were retained which could inform the analyst how much labor, equipment, or supplies were expended in the development of specific courses. However, the existence of an accounting system for IPDCs may remedy this difficulty. As the centers come down their learning curves and their costs moderate, analysts will have available an excellent source for development cost estimates. To insure complete developmental cost data which can be tracked to the course being developed, it is recommended that IPDC managers account for the hours of effort expended by their employees on courses being developed.

PROJECTING TEACHING/STAFF RATIOS AND STUDENT COURSE TIME. Note in the hypothetical example that the "student compensation" was greatest for conventional instruction, 20 percent less for instructor managed individualized instruction, and 30 percent less for computer managed individualized instruction. This is based on the fact that most research shows considerable savings in students' learning time when individualized instruction replaces conventional instruction; some research has indicated a further savings when a self-paced course is converted from instructor managed to computer managed.

The problem is that some of the research is sketchy and controversial. Therefore, the cost analyst should (1) keep abreast of new research as it evolves and (2) seek and carefully consider professional educators' opinions on what they believe will be the actual time savings for the course being analyzed.

Note also that in the example the staff costs decreased proportionally with student costs; i.e., the student/staff ratios were constant for all three alternative training systems. Again, these ratios are a subject of some controversy in research and in managerial guidance. Therefore, the analyst must again consider current research and current managerial policies when evaluating staff requirements.

COST ANALYST EXPERTISE. All the "how-to" instructions for cost analysis contain one common caveat--the analyst must account for all the relevant economic costs of the resources. In many instances, the economic costs are equivalent to the purchase price of the item. However, in other instances the economic costs have no relationship to the purchase price, and therefore must be valuated by the analyst.

For example, assume that a training center owns a large central computer with much unused capacity and that it has been determined that this capacity will be reserved solely for future CMI use. If one were to perform a cost-effective analysis today in which CMI was being compared with IMI, the computer costs for IMI would be zero (since no computer is used) and would also be zero for CMI because idle computer space is being reserved for its use. The zero costing for the computer in this situation is totally compatible with sound, accepted managerial practice. Recall that one only counts relevant costs and that relevant costs are future costs; i.e., not yet sunk. The computer in this example was purchased in the past and is being reserved for CMI use; therefore, no future costs will result from its use tomorrow. However, given the same situation except for the fact that the excess computer capacity can now be used by other activities and that there are other activities waiting to use it, the computer would have to be valuated in the CMI alternative at approximately today's replacement value (not at the past purchase price).

Economic analyses are situational, expecially when one is dealing with long-term capital expenditures such as computers and facilities. Such proposed purchases should be evaluated by people with sufficient expertise to determine their true economic costs if meaningful and correct cost analyses are desired.

MAJOR ECONOMIC TRADE-OFFS

Unfortunately, as evidenced by the preceding discussion, very few concrete, irrefutable rules can be made about efficiency and teaching strategies. One cannot say that "all courses with AOBs greater than X should be individualized and those with less should be taught conventionally." One can only say "the ultimate course strategy should be determined by relevant costs, and relevant costs depend on the relative costs of the productive resources used in the course."

However, major trade-offs can be identified which might help in strategic managerial planning:

CMI VS. IMI. An individualized course can be either computer managed or instructor managed. This is the old issue of whether to automate or do something manually. As ADP costs become lower, vis-a-vis personnel costs, one might expect the use of computer management to become increasingly attractive.

INDIVIDUALIZED VS. CONVENTIONAL STRATEGIES. Research indicates that individualized instruction saves at least 20 percent in student time or salaries paid, when compared to conventional instruction. Since student salaries are the largest costs in the total training budget, even small percentage savings in student time can lead to appreciable dollar savings.

However, individualization is not a free good. It is more expensive to develop the course and to manage the students in individualized instruction than in conventional instruction. Therefore, the savings in student time must be carefully weighed against increased development and student management costs which evolve from the individualized strategy. The equilibrium point of the trade-off must be that point where the relevant costs are minimized.

CONCLUSION

Given the real world situation of ever tightening availability of resources, it becomes increasingly necessary for the Navy to get "more" for "less." Educators must continually search for methods which will effectively train the service's people. Once these methods are established, the decision on which to implement must be made on the basis of costs, since costs are the only measurement one has of the relative scarcity of productive resources. Only by insuring the most cost effective means of operation can the Navy get the most training from the resources it is given.

APPENDIX C

A LISTING OF INDIVIDUALIZED COURSES CURRENTLY SHOWN ON NITRAS

Method of Instruction (MI) code:

B = Both self-paced and computer managed

C = Computer managed only

P = Self-paced only

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D,(METH-INST = B OR C OR P) AND REC302 P.
S,METH-INST,CIN,CDP.
C,CDP,$GRD = SUM(S-ACT-GRD-25 + S-ACT-GRD-26 + S-ACT-GRD-27 +
S-ACT-GRD-28 + S-ACT-GRD-29 + S-ACT-GRD-30 + S-ACT-GRD-31 + S-ACT-GRD-32 +
S-ACT-GRD-33 + S-ACT-GRD-34 + S-ACT-GRD-35 + S-ACT-GRD-36).
C,CDP,$ENR = SUM(S-ACT-ENR-25 + S-ACT-ENR-26 + S-ACT-ENR-27 +
S-ACT-ENR-28 + S-ACT-ENR-29 + S-ACT-ENR-30 + S-ACT-ENR-31 + S-ACT-ENR-32 +
S-ACT-ENR-33 + S-ACT-ENR-34 + S-ACT-ENR-35 + S-ACT-ENR-36).
C,CDP,$AOB = SUM(S-ACT-AOB-25 + S-ACT-AOB-26 + S-ACT-AOB-27 +
S-ACT-AOB-28 + S-ACT-AOB-29 + S-ACT-AOB-30 + S-ACT-AOB-31 + S-ACT-AOB-32 +
S-ACT-AOB-33 + S-ACT-AOB-34 + S-ACT-AOB-35 + S-ACT-AOB-36) / 12.
F,TAEG1 TITLE,TAEG2 CDP.
```

TPC	CIN	CDP	COURSE TITLE	TC	MI	FY79 ENR	FY79 GRD	FY79 AOB
4A000	A-012-0036	3694	IND INST /FINIS	C4	B	0	0	0
03124	A-100-0010	6018	BE/E-USMC OTHER	AP	B	0	0	0
03124	A-100-0010	6230	BE/E-AT	AP	B	2093	1739	282
03124	A-100-0010	6231	BE/E-AQ	AP	B	603	496	84
03124	A-100-0010	6232	BE/E-AX	AP	B	429	345	67
03124	A-100-0010	623[illegible]	[illegible]/E - TD	AP	B	506	439	44
03124	A-100-0010	[illegible]	[illegible] - AV NONNAV	AP	B	564	395	82
03124	A-100-0010	[illegible]	[illegible]-AF	AP	B	3318	2862	480
03124	A-100-0010	[illegible]	BE/E-AO	AP	B	101	53	14
03124	A-100-0010	6237	BE/E-ASE	AP	B	242	178	36
03124	A-100-0010	6238	BE/E - AVR/FINIS	AP	B	0	5	1
03124	A-100-0010	6248	BE/E-FTG	AP	B	454	382	118
03124	A-100-0010	6249	BE/E-FTM	AP	B	439	418	100
03124	A-100-0010	6254	BE/E-EW	AP	B	140	111	42
03124	A-100-0010	6255	BE/E-ET-RAD-NF	AP	B	412	341	93
03124	A-100-0010	6256	BE/E-ET-COMM-NF	AP	B	160	497	44
03124	A-100-0010	6257	BE/E-EW-CTM	AP	B	85	73	24
03124	A-100-0010	6258	BE/E-FM	AP	B	1683	1096	418
03124	A-100-0010	6259	BE/E-CE	AP	B	94	73	47
03124	A-100-0010	6270	BE/E-CE	AP	B	84	74	15
03124	A-100-0010	6271	BE/E-ET-COMM-NF	AP	B	101	175	39
03124	A-100-0010	6272	BE/E-ET-RAD-NF	AP	B	216	204	44
03124	A-100-0010	6273	BE/E-EM	AP	B	747	629	154
03124	A-100-0010	6274	BE/E-IC	AP	B	1041	915	251
03124	A-100-0010	6275	BE/E-EW	AP	B	112	82	29
03124	A-100-0010	6276	BE/E-STG	AP	B	606	521	131
03124	A-100-0010	6277	BE/E-STS	AP	B	359	283	71
03124	A-100-0010	6303	BE/E-EM	AP	B	822	782	125
03124	A-100-0010	6304	BE/E-ET-COMM-NF	AP	B	44	40	9
03124	A-100-0010	6305	BE/E-ET-RAD-NF	AP	B	35	29	6
03124	A-100-0010	6306	BE/E-EW	AP	B	238	204	56
03124	A-100-0010	6307	BE/E-CE	AP	B	97	95	15
03124	A-100-0010	6308	BE/E-EW-CTM	AP	B	269	250	57
03124	A-100-0010	6309	BE/E-DS	AP	B	265	277	65
03124	A-100-0010	6310	BE/E-FTG	AP	B	183	152	34
03124	A-100-0010	6311	BE/E-FTM	AP	B	179	189	34
03124	A-100-0010	6312	BE/E-GMC	AP	B	124	99	18
03124	A-100-0010	6313	BE/E-GMM	AP	B	55	53	9
03124	A-100-0010	[illegible]	[illegible]	AP	B	30	12	4
03124	A-100-0010	6345	BE/E-IC	AP	B	343	313	52
03124	A-100-0010	6349	BE/E-IM-SUP	AP	B	209	247	41
03124	A-100-0010	6350	BE/E-RM/4YO	AP	B	134	124	28
03121	A-100-0010	6352	BE/E-RM(SS)-6YO	AP	B	92	68	16
03124	A-100-0010	6355	BE/E-OSE	AP	B	40	22	8
03124	A-100-0010	[illegible]	BE/E - RM/FINIS	AP	B	0	0	0
03124	A-100-0010	[illegible]	BE/E-FTM	AP	B	142	170	50
03124	A-100-0010	[illegible]	BE/E-FTG	AP	B	172	128	45
03124	A-100-0010	[illegible]	BE/E-EW-CTM	AP	B	[illegible]	57	[illegible]
03124	A-100-0010	[illegible]	BE/E-OMT-ASROC	AP	B	117	90	20
03124	A-100-0010	6362	BE/E-GMG	AP	B	130	95	24

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TPC	CIN	CDP	COURSE TITLE	TC	M	*	FY79	*
					I	ENR	GRD	AOB
03121	A-100-0010	6363	BE/E-GMM	AP	B	86	85	16
03121	A-100-0010	6365	BE/E-NON A-SCHL	AP	B	20	19	4
03121	A-100-0010	6366	BE/E-DS	AP	B	164	142	43
03121	A-100-0010	6367	BE/E-IC	AP	B	85	19	47
03121	A-100-0010	6368	BE/E-GMM	AP	B	162	132	30
03121	A-100-0010	6369	BE/E-OMT-ASROC	AP	B	159	116	29
03121	A-100-0010	6370	BE/E-GMG	AP	B	391	325	63
03121	A-100-0010	6372	BE/E-GSE	AP	B	95	76	22
03121	A-100-0010	6382	BE/E-EM/IC C7-1	AP	B	45	47	13
03121	A-100-0010	6403	BE/E-COMM-AEF	AP	B	397	369	75
03121	A-100-0010	6404	BE/E-FTG (SS)	AP	B	49	41	13
03121	A-100-0010	6405	BE/E-ET-COMM-4YO	AP	B	227	211	39
03121	A-100-0010	6406	BE/E-ET-RAD-4YO	AP	R	242	220	43
03121	A-100-0010	6407	BE/E-ET-RAD-AEF	AP	B	309	267	53
03121	A-100-0010	6408	BE/E-ET-COMM-4YO	AP	B	16	10	5
03121	A-100-0010	6409	BE/E-ET-COMM-AEF	AP	B	160	135	44
03121	A-100-0010	6410	BE/E-FTG (SS)	AP	B	121	100	32
03121	A-100-0010	6411	BE/E-ET-RAD-4YO	AP	B	23	19	6
03121	A-100-0010	6412	BE/E-ET-RAD-AEF	AP	B	212	165	55
03121	A-100-0010	6413	BE/E-FTG (SS)	AP	B	51	53	17
03121	A-100-0010	6414	BE/E-ET-COMM-AEF	AP	B	250	304	80
03121	A-100-0010	6415	BE/E-ET-COMM-4YO	AP	B	57	72	18
03121	A-100-0010	6416	BE/E-ET-RAD-4YO	AP	B	244	156	50
03121	A-100-0010	6417	BE/E-ET-RAD-AEF	AP	B	844	615	205
03121	A-100-0010	6440	BE/E-EM/IC-C7-2	AP	B	1	0	0
03121	A-100-0010	6445	BE/E CTM(S/FINIS	AP	B	1	1	0
03121	A-100-0010	6446	BE/E-ET (SU) EW	AP	B	0	0	0
03121	A-100-0010	6447	BE/E-ET (SU) EW	AP	B	2	0	0
03121	A-100-0010	6449	BE/E CTM(S/FINIS	AP	B	11	11	5
03121	A-100-0010	6450	BE/E-ET (SU) EW	AP	B	2	0	0
03121	A-100-0010	6542	BE/E-GSE	AP	B	13	0	2
03121	A-100-0010	6543	BE/E-GSM	AP	B	2	0	0
03121	A-100-0010	6544	BE/E-GSM	AP	B	44	34	9
03121	A-100-0010	6545	BE/E-GSM	AP	B	209	156	36
03121	A-100-0010	6548	BE/E-TM /FINIS	AP	B	5	5	1
03121	A-100-0010	6549	BE/E-TM-SUB	AP	B	4	2	1
03121	A-100-0010	6550	BE/E-TM-ADVANCE	AP	B	1	0	0
03121	A-100-0010	6551	BE/E-TM-SUB	AP	B	2	0	0
03121	A-100-0010	6552	BE/E-TM /FINIS	AP	B	1	0	0
03111	A-202-0011	6144	RM A BASIC	A1	B	2840	2598	695
03111	A-202-0026	6380	RM A EEA	A1	B	1702	1016	113
03111	A-202-0027	6381	RM A SHORE	A1	B	811	809	34
03360	A-651-0010	6260	PROP ENG BAS BT	AP	B	3355	3475	437
03360	A-651-0010	6261	PROP ENG BAS EN	AP	B	1580	1656	217
03360	A-651-0010	6262	PROP ENG BAS MM	AP	B	4267	4226	523
03340	A-651-0049	2658	BU/FW T/T CERT	F1	B	853	614	12
03340	A-651-0049	266A	BU/FW T/T CERT	F1	B	131	111	2
03340	A-651-0049	4454	HAG ABC CONS OPR	C1	B	15	17	3
03340	A-651-0050	4455	BAI ABC CONS OPR	C1	B	26	25	3
03340	A-651-0051	2594	BU/FW T/T /FINIS	F1	B	7	3	0

TPC	CIN	CDP	COURSE TITLE	TC	MI	* ENR	FY79 GRD	AOB *
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03310	A-651-0051	2657	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03310	A-651-0054	0118	AUXBOIL CNIPHDBS [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03310	A-651-0056	2840	ACC OP REF HAGAN	F1	B	0	0	0
03310	A-651-0057	2839	BAIACCOP/RFR	F1	B	0	0	0
08140	C-601-2010	6501	AD A1	A1	B	3073	2908	386
03530	H-201-5217	200X	COM SEC CNTR MEA	F1	B	7	7	0
TLAN6	J- 2G-0355	9290	NTDS WDS MK11	F2	B	0	0	0
TLAN6	J- 2G-0356	528K	NTDS WDS MK11	F2	B	0	0	0
TLAN2	J-221-0316	408R	MINCTRMEAHELOCON	C1	B	22	27	1
TLAN2	J-221-0319	280H	HELO TRANSIT CON	F1	B	108	80	1
TLAN4	J-221-0510	8981	TMA/SSPP	F1	B	85	83	1
P0211	K-061-2158	4553	NAV-LORAN	F1	B	9	9	0
P0211	K-580-2125	536T	SENIOR RM /FINIS	F R	B	0	0	0
P0023	K-652-2097	534E	ENG CONT/GOV/REG	F1	B	0	0	0
P0231	K-652-2146	4120	HYDR SYS COM	C1	B	140	92	14
41403	L- 00-0017	9442	WARSHIP RE/FINIS	F2	B	50	50	0
03121	A-100-0010	6269	BE/E-DS	AP	C	307	282	72
03122	A-102-0209	602A	EW-A BASIC OPS	A1	C	358	330	48
03132	A-198-0031	413J	ADV ELEC/ELECT M	C1	C	0	0	0
03132	A-198-0032	413K	ADV MICRO MEAS	C1	C	0	0	0
08140	C-000-2010	6211	AFUN ADR/FINIS	AP	C	0	0	0
08140	C-000-2010	6225	AFUN AC /FINIS	AP	C	1	1	0
08140	C-000-2010	6227	AFUN AVR/FINIS	AP	C	0	0	0
08130	C-100-2013	6239	AVA AT A1	A1	C	1763	1237	52[illegible]
08130	C-100-2013	6240	AVA AQ A1	A1	C	497	[illegible]	[illegible]
08130	C-100-2013	6241	AVA AX A1	A1	C	356	249	114
08130	C-100-2013	6242	AVA TD A1	A1	C	445	350	106
08130	C-100-2013	6243	AVA NON NAVY A1	A1	C	1009	716	293
08140	C-950-2010	6210	AFUN AD	AP	C	3031	3012	192
08140	C-950-2010	6212	AFUN AME	AP	C	688	683	52
08140	C-950-2010	6213	AFUN AMH	AP	C	1250	1258	84
08140	C-950-2010	6214	AFUN AMS	AP	C	1724	1746	126
08140	C-950-2010	6215	AFUN ASE	AP	C	249	252	16
08140	C-950-2010	6216	AFUN ASH	AP	C	188	188	12
08140	C-950-2010	6217	AFUN ASM	AP	C	327	306	21
08140	C-950-2010	6218	AFUN AE	AP	C	3347	3355	195
08140	C-950-2010	6219	AFUN AT	AP	C	2048	2041	110
08140	C-950-2010	6220	AFUN AQ	AP	C	608	595	37
08140	C-950-2010	6221	AFUN AX	AP	C	471	472	24
08140	C-950-2010	6222	AFUN TD	AP	C	475	471	25
08140	C-950-2010	6223	AFUN NON-NAVY	AP	C	393	388	17
08140	C-950-2010	6224	AFUN AW	AP	C	582	568	23
08140	C-950-2010	6226	AFUN AO	AP	C	1457	1448	107
08140	C-950-2010	6228	AFUN AFFR	AP	C	201	202	12
08140	C-950-2010	6229	AFUN BASHEL	AP	C	727	697	48
CNALF	D-602-0521	8897	SH3 WEAPON SY MA	C1	C	34	28	6
CNALF	D-602-0590	8095	SH3 SAFE/SURV MA	C1	G	0	0	0
CNALF	D-646-0540	8896	SH3 ARM SYS MAI	C1	C	14	13	2
41407	A- 00-0057	9730	DSRV/MOSUB CRSE	F1	P	14	14	1
03530	A- 00-0121	204R	PCO/XO SHI/FINIS	F2	P	0	0	0

TPC	CIN	CDP	COURSE TITLE	TC	MI	FY79 ENR	FY79 GRD	FY79 AOB
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03400	A- 38-0012	016Z	NAVBEC[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03400	A- 38-0014	417M	NSG JR OFF ORIEN[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03132	A- 4B-0018	0197	PEMO-PACFLT	C2	P	89	70	16
03350	A- 4G-0010	3218	DC ASSISTANT	A2	P	202	209	29
03350	A- 4G-0014	0332	NBC OFFICE/FINIS	C2	P	0	0	0
03350	A- 4G-0021	9625	APPLIED DC/FINIS	C2	[illegible]	[illegible]	[illegible]	[illegible]
4A000	A-012-0012	402P	LC INSTR [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
04A00	A-012-0012	402Z	INST[illegible]LS /FINIS	C1	P	[illegible]	[illegible]	[illegible]
4A000	A-012-0012	403V	LC INSTR	C1	P	102	113	17
4A000	A-012-0012	8648	LC INSTR	C1	P	0	0	0
03132	A-100-0019	7300	DPAT/FINIS	C1	P	0	0	0
41423	A-100-0045	2296	BAS DIG FU/FINIS	A2	P	[illegible]	[illegible]	0
41422	A-100-0045	515Z	BAS DIG FUND	F1	P	[illegible]	246	[illegible]
03132	A-101-0031	3263	AN/WRT-2 /FINIS	C1	P	[illegible]	[illegible]	0
03132	A-102-0040	3276	AN/UPN-12 /FINIS	F1	P	0	0	0
03132	A-102-0040	8043	AN/UPN-12 /FINIS	F1	P	0	0	0
03400	A-102-0109	6461	CTM A	A3	P	264	248	84
03123	A-102-0155	6299	EW OP TECH/FINIS	A1	P	0	0	0
03400	A-102-0205	4325	HI-VAL SOLDERING	C3	P	8	5	1
03122	A-102-0209	602D	EW-A ADV OPS	A1	P	60	44	4
41437	A-123-0134	3665	TEST EQUIP 37	C1	P	15	11	2
41437	A-123-0139	3670	TORP 46 TEQ	C7	P	26	14	3
41437	A-123-0147	3698	TORP TECH ADV	C1	P	50	41	12
03111	A-160-0062	406Z	CRYP KY-3 MAT	[illegible]	[illegible]	[illegible]	26[illegible]	[illegible]
03111	A-160-0075	471V	CRYP KW-26 MAINT	C1	[illegible]	14	19	[illegible]
43312	A-198-0026	520Z	TEST EQUIP	F1	P	388	380	5
03111	A-201-0022	5382	MORSE CODE OP	C1	P	354	242	86
03400	A-231-0012	2063	CTR HRDF O/FINIS	C3	P	0	0	0
03400	A-231-0024	2053	CTT FLR11 /FINIS	A3	P	0	0	0
03400	A-231-0025	3432	CTT FLEXSC/FINIS	C3	P	0	0	0
03400	A-231-0026	2054	CTT ADV NO/FINIS	C3	P	0	0	0
03122	A-231-0028	3497	CTT ELINT OP	A3	P	58	52	16
03400	A-231-0032	5430	CTT NMCA /FINIS	C3	P	0	0	0
03400	A-231-0044	6301	CTR A	A3	P	487	444	266
03400	A-231-0045	6302	CTT A PREP	A3	P	986	698	322
03400	A-231-0046	6320	CTT SPE NON-MRSE	A3	P	501	499	74
03400	A-231-0047	6319	CTT ICR/FLEXSCOP	A3	P	132	129	26
03400	A-231-0048	4376	CTT SNMC/0	C7	P	34	27	10
03400	A-231-0051	6455	CTT WBS OP	A3	P	69	53	12
03400	A-240-0020	303N	CTO TACSOM	C3	F	63	71	17
03350	A-495-0010	6106	HT A-2	A1	P	1071	1012	207
03350	A-495-0010	6339	HT A-2	A1	P	1235	1227	181
03350	A-495-0035	6119	HT A-1	A1	P	1084	960	152
03350	A-495-0040	5340	DC REP PARTY LDR	C1	P	162	154	9
03350	A-495-0051	9511	GAS FREE ENGINER	C2	P	32	32	0
03350	A-495-2037	528Z	DC-P250 PMP REF	F1	P	72	70	1
04230	A-500-0014	6102	EN A	A1	P	910	893	129
04230	A-510-0012	6057	YN A	A1	P	1260	1146	212
03400	A-510-0015	6020	CTA A	A3	P	201	163	55
04230	A-515-0018	6300	PC A	A1	P	101	103	12

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TPC	CIN	CDP	COURSE TITLE	TC	MI	ENR	GRD	AOB
						* FY79		*
03210	A-532-0012	4474	BASIC PROG/FINIS	C1	P	0	10	0
03210	A-532-0012	470S	BASIC PROGRAMING	C1	P	0	0	0
03210	A-532-0015	470P	COBOL PROGRAMING	C1	P	0	0	0
03400	A-532-0016	3213	CTT FLEXSCOP PRO	C3	P	7	2	2
03210	A-532-0019	7832	DP SYS /FINIS	C1	P	2	2	0
03210	A-532-0025	470Q	ASSEMBLY PROGRAM	C1	P	0	0	0
03210	A-532-0026	470R	FORTRAN PROGRAM	C1	P	0	0	0
04240	A-551-0014	6059	SK CLASS A	A1	P	800	823	120
00112	A-561-0002	6553	RP A	A1	P	41	32	9
04230	A-570-0213	8014	NEWSPAPER EDITOR	C1	P	10	10	2
03400	A-580-0017	3430	CTO HFDF/FINIS	C3	P	3	13	2
41221	A-623-0052	500Y	TM TY S CMB MA	F1	P	81	81	0
41221	A-623-0059	500Z	TM TY M CMB MA	F1	P	114	114	0
41221	A-623-0067	501B	TM TY M PB CMBMA	F1	P	0	0	0
03310	A-650-0014	200R	ENG MAR PR/FINIS	F1	P	0	0	0
03310	A-650-0014	200S	ENG MAR PR/FINIS	F1	P	0	0	0
03360	A-651-0010	8562	PROP ENG BAS GS	AP	P	111	100	10
03310	A-651-0046	4315	GR ABC CONS OPR	C1	P	58	36	7
03310	A-651-0049	4314	HAG ABC CONS OPR	C1	P	36	21	4
03310	A-651-0050	4313	BAI ABC CONS OPR	C1	P	28	20	4
03310	A-651-0052	6486	BT CL A 1200 PSI	A1	P	2167	2220	452
03360	A-651-0053	6492	MMCLA1200PSICSE	A1	P	2264	2414	378
41213	A-651-0062	7663	STM COMP ADV MA	F1	P	0	0	0
03310	A-651-0081	6489	BT CL A 600 PSI	A1	P	834	861	111
03360	A-651-0082	6493	MMCLA600PSICSE	A1	P	1979	2394	260
03360	A-651-0104	2000	PROP ENG BASIC	F1	P	94	86	3
03360	A-651-0104	413U	PROP ENG BASIC	C1	P	80	54	11
03360	A-652-0018	6487	EN CE A	A1	P	1592	1611	124
41213	A-652-0121	33[illegible]	FLT WR EQ /FINIS	F1	P	0	0	0
43223	A-652-0124	[illegible]	[illegible] XFER/FINIS	F1	P	0	0	0
41213	A-652-0132	331D	TG CONT OIL	F1	P	0	0	0
03330	A-652-0134	2859	BECTEC	F1	P	75	57	12
41223	A-661-0043	331H	OX ANAL C CMB MA	F1	P	0	0	0
41221	A-661-0043	504C	OX ANAL C CMB MA	F1	P	32	32	0
41402	A-662-0041	275Z	SIL ZINC BATT	F1	P	14	14	2
03112	A-670-0010	6046	IMA	A1	P	65	64	30
03112	A-670-0018	6047	CMA	A1	P	44	44	16
03112	A-670-0028	4952	IBM SELEC REPAIR	C1	P	1	1	0
03112	A-670-0029	4953	ELEC TYPE REPAIR	F1	P	0	0	0
03112	A-670-0031	4955	RIM ADD/FINIS	C1	P	0	0	0
03112	A-670-0032	4954	FRID CAL/FINIS	C1	P	0	0	0
03112	A-670-0034	320E	ELECT CALC REP	C1	P	0	0	0
03112	A-670-0045	269Y	COMB COP/DUP REP	F1	P	0	0	0
03320	A-690-0077	2599	PROBE MAINT	F1	P	70	69	1
03350	A-701-0024	26AY	FUEL GAS BRAZING	C1	P	0	0	0
03350	A-701-0024	6279	FUEL GAS B/FINIS	C1	P	0	0	0
03423	C- 2D-2014	9599	AVGO /FINIS	C2	P	0	0	0
03423	C- 2D-3809	9796	NFO REFRES/FINIS	C2	P	0	0	0
08140	C-000-2010	6208	AFUN AP/FINIS	AP	P	0	0	0
08110	C-000-2013	6203	AVFUN AG /FINIS	AP	P	0	0	0

TPC	CIN	CDP	COURSE TITLE	IC	MI	FY79 ENR	GRD	AOB
08120	C-000-3177	2203	CORROSION CONT	F1	P	200	162	18
08120	C-000-3177	2698	CORROSION CONT	F1	P	0	0	0
08120	C-000-3192	272K	CORROSION /FINIS	F1	P	169	167	13
08120	C-000-3192	272L	CORROSION /FINIS	F1	P	502	494	3
08130	C-000-3192	2807	CORROSION /FINIS	F1	P	21	21	0
08120	C-000-3192	281A	CORROSION CONT	F1	P	24	25	1
08120	C-000-3192	281N	CORROSION /FINIS	F1	P	357	354	2
08120	C-000-3192	281P	/FINIS	F1	P	673	675	7
08120	C-000-3192	281Q	CORROSION /FINIS	F1	P	51	51	1
08120	C-000-3192	281R	CORROSION CONT	F1	P	214	211	4
08120	C-000-3192	281S	CORROSION /FINIS	F1	P	502	513	33
08120	C-000-3192	281T	CORROSION CONT	F1	P	673	691	47
08120	C-000-3192	281U	CORROSION /FINIS	F1	P	18	18	0
08120	C-000-3192	281V	CORROSION CONT	F1	P	494	494	10
08120	C-000-3192	281W	CORROSION CONT	F1	P	97	92	6
08120	C-000-3192	281X	CORROSION /FINIS	F1	P	574	554	43
08120	C-000-3192	281Y	CORROSION /FINIS	F1	P	230	219	3
08120	C-000-3192	281Z	CORROSION /FINIS	F1	P	413	411	2
08120	C-000-3192	282A	CORROSION CONT	F1	P	52	57	4
08120	C-000-3192	282B	CORROSION CONT	F1	P	99	90	5
08120	C-000-3192	282C	CORROSION /FINIS	F1	P	1097	1119	24
08120	C-000-3192	282D	CORROSION /FINIS	F1	P	89	94	4
08120	C-000-3192	282E	CORROSION CONT	F1	P	80	76	5
08120	C-000-3192	8588	CORROSION /FINIS	F1	P	207	211	15
08130	C-191-2010	4521	TD A1	A1	P	348	339	40
08110	C-400-2010	3584	MOPIC	C1	P	61	44	16
08110	C-400-2011	4523	PH LEVEL 1	A1	P	537	444	136
08110	C-400-2012	4512	PH LEVEL 2/FINIS	C7	P	0	0	0
08110	C-400-2020	401L	PHOTO LAB TECH	C1	P	95	32	8
08110	C-400-2021	401M	ILLUSTR PHOTO	C1	P	58	25	4
08110	C-400-2022	401K	STILL DOCUMENT	C1	P	55	22	5
08110	C-400-2023	4579	MAR PH LAB/FINIS	A1	P	0	0	0
08110	C-400-2024	4520	MAR MOPIC /FINIS	A1	P	0	1	0
08110	C-420-2010	6472	AG A1	A2	P	407	332	134
04240	C-551-2010	6522	AK/A	A1	P	625	597	99
08110	C-602-2010	6519	PR BASIC	A1	P	489	505	112
08110	C-602-2011	4509	PR ADVANCED	C1	P	118	93	18
08110	C-602-2020	7764	NP/I/	C1	P	100	92	7
08110	C-602-2021	7765	NP/II/	C1	P	12	12	2
08110	C-602-2022	7766	NP/III/	C1	P	8	8	1
08110	C-670-2012	3580	PHER	C1	P	33	14	8
08110	C-950-2010	6260	AVFUN-ABE	AP	P	[illegible]	406	15
08110	C-950-2013	6261	AVFUN-ABH	AP	P	342	365	21
08110	C-950-2013	6282	AVFUN-ABF	AP	P	237	257	9
08110	C-950-2013	6284	AVFUN PR	AP	P	457	470	14
081M0	C-950-2013	6285	AFUN MALRE	AP	P	95	120	4
CNAPA	E- 20-0072	803Y	ASW NFO P3B MOD	F2	P	24	23	7
41201	F- 4H-0026	503V	NUC ENG OFF	C2	P	64	60	9
41202	F- 4H-0026	9275	NUC ENG OFF	C2	P	53	56	9
41201	F- 4H-0027	015U	TOP WACHEM RADCON	C2	P	48	36	5

TPC	CIN	CDP	COURSE TITLE	TC	MK	FY79		
					I	ENR	GRD	AOB
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41200	F-000-0022	8709	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41404	F-000-0043	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41202	F-000-0079	515Y	ENG IC TRAINER	F1	P	2921	2921	7
41201	F-000-0083	538E	NUCPROPPLTOPREF	C1	P	47	52	7
41412	F-130-0014	519K	CHART READ	F1	P	113	84	6
41422	F-190-0014	264J	ANFORM-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B4113	F-623-0012	524J	AMC SYSTEM/FINIS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41202	F-670-0022	270U	T I D [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41201	F-701-0018	2156	RELUC ROD CONT	F1	P	84	84	0
41201	F-701-0021	2159	PPIP MAGNETIC	F1	P	15	15	0
41201	F-701-0022	2160	PPIP TRANSISTOR	F1	P	21	21	0
41201	F-701-0023	2161	PPIP CCC[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
41201	F-701-0025	2163	SOWLC EQUI[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41201	F-701-0026	2171	NI DAYSTRM TRANS[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41201	F-701-0029	2166	APD EQUIP	F1	P	23	23	0
41201	F-701-0030	2167	PMP NOISE MONIT	F1	P	22	22	0
41201	F-701-0031	2168	PRI LOOP COMPONE	F1	P	0	0	0
41201	F-701-0033	2169	ELT REFRESHER	F1	[illegible]	[illegible]	[illegible]	0
41201	F-701-0034	2170	RADIOACT SPILL T	F1	[illegible]	[illegible]	[illegible]	0
41202	F-701-0034	523B	RADIOACT SPILL T	F1	P	4078	4078	[illegible]
41202	F-701-0035	523C	SECONDARY CHEM	F1	P	13	13	0
TLAN6	G- 2E-6303	9476	PHIB COMD ORNT	F2	P	5	5	0
03530	H- 2E-5241	9249	PHIB COMD ORIENT	F2	P	2	2	0
TLAN2	J- 2G-0385	2710	FOROFFPCTCOFF[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TLAN2	J- 2G-0390	271H	NON-NATO CIG [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TLAN5	J- 2G-0614	8749	PCO/XO SHIPHDLNG	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TLAN6	J-123-0570	265S	LAMPS TORP LOAD	F1	P	111	98	9
TLAN5	J-201-0801	538D	INTER MORSE CODE	C1	P	183	71	32
TLANG	J-221-0335	5178	AAW TEAM TRAININ	F1	P	0	0	0
TLAN	J-780-0034	0108	FF - SPBD	[illegible]	[illegible]	[illegible]	[illegible]	0
TLAN	J-780-0034	0109	FF - SPBD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TLAN	J-780-0410	0118	FIRE FIGHT/FINIS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TLAN	J-780-2035	0116	DC PLASTIC REP	F1	P	0	0	0
TLANT	J-780-2035	0117	DC PLASTIC REP	F1	P	0	0	0
P0022	K- 2E-2104	9332	PCO/PXO REVIEW	F2	P	1	1	0
P0231	K- 4H-2146	276S	POL OILER PCO/XO	F2	P	4	5	0
P0022	K-430-1063	512U	2	F1	P	237	214	23
P0021	K-221-0044	4570	AIC MAINT PROF	F1	P	87	87	0
P0022	K-500-2040	540J	CIAC	F1	P	567	547	8
P0231	K-821-2039	268V	JP5 FUEL SYS	F1	P	213	172	18
P0231	K-821-2444	269X	FUEL ACCOUNT	F1	P	206	152	17
41404	L- 00-0017	9984	WARSHIP RECOG	F2	P	0	0	0
41203	L- 4H-0026	9438	PROS NUC ENG\OFF	C2	P	21	30	5
41424	L-402-0010	2919	ESM SIG RECOG	F1	P	6	0	0
44203	L-623-0012	2547	SP PHONE COMM TM	F1	P	557	559	2
40223	L-652-0049	2305	7L46 GEN T/FINIS	F1	P	0	0	0
44203	L-664-0044	334M	SEC CHEM TM TNG	F1	P	478	478	0
41203	L-661-0045	334N	RC EQUIP MISC	F1	P	42	42	0
41203	L-661-0046	334P	PRP PLT MECH EQP	F1	P	0	0	0
41203	L-661-0047	334Q	RAD CONT TM TNG	F1	P	409	413	4

TPC	CIN	CDP	COURSE TITLE	TC	MI	* ENR	FY79 GRD	AOB *
41203	L-661-0048	331R	PRP PLT ELEC EQP	F1	P	0	0	0
41203	L-661-0049	331S	PRIM CHEM TM TNG	F1	P	65	65	0
41203	L-661-0052	2566	PRI VALV MAINT	F1	P	326	248	27
41203	L-661-0053	206Q	REAC CON EQP/NID	F1	P	103	103	0
41203	L-661-0054	206R	REAC CON EQP/PPI	F1	P	71	71	0
41203	L-661-0055	206S	REAC CON EQP/R C	F1	P	45	45	0
41203	L-661-0056	206T	REAC CON EQP/[illegible] A	F1	P	52	52	0
41203	L-661-0057	206U	REAC CON EQP/CRM	F1	P	0	0	0
41203	L-661-0058	206V	REAC CON EQP/SGW	F1	P	89	89	0
41203	L-661-0059	2656	TLD	F1	P	3	3	0
04240	Y-444-4440	6511	NAVMAR TYP INDOC	AP	P	872	872	24
08140	X-444-4441	6297	NSI MP	AP	P	10427	10282	207

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